

Community and locally owned renewable energy in Scotland at September 2015

A report by the Energy Saving Trust for the Scottish Government

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About the Energy Saving Trust

The Energy Saving Trust is Scotland and the UK's leading impartial organisation helping people save energy, reduce carbon emissions and use water more sustainably. We do this by directly supporting consumers to take action, helping local authorities and communities to save energy, using our expert insight and knowledge and providing quality assurance for goods and services.

This work was carried out by the Energy Saving Trust on behalf of the Scottish Government. The report draws on various sources of data from the Energy Saving Trust and other organisations working in Scotland.

With thanks to:

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SFHA

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UK Department of Energy and Climate Change

Community Energy Scotland

Scottish Renewables

We would also like to extend our thanks to the many other organisations and individuals who also helped with time or information.

Please note: the methodology used in this report to calculate renewable capacity and output may not necessarily be in line with that required by the EU Renewable Energy Directive and as such the figures should not be used for any reporting purposes associated with this Directive.

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1. Summary of key findings

In 2011, the Energy Saving Trust was asked by the Scottish Government to produce a database of all community and locally owned renewable energy installations in Scotland and to produce a short report on the information it contained. The objective of this work was to monitor progress toward the target set by the Scottish Government of 500MW of community and locally owned renewable energy capacity operating in Scotland by 2020¹.

This database has since been updated annually and this is the fifth iteration of its associated report. The database includes, as far as possible, all installations known to be operating, under construction, or in earlier stages of development as of September 2015.

‘Community and locally owned’ is defined as the installed capacity owned by:

- Community groups
- Local authorities
- Housing associations
- Other Scottish public bodies
- Charities, including faith organisations
- Further and higher education establishments
- Local businesses
- Scottish farms and estates

The findings from this work are that at the end of September 2015:

- An estimated minimum of **508MW**² of community and locally owned renewable energy capacity was operational in Scotland.
- This is a **41% increase** on the operational capacity in the last report (capacity at June 2014), when the operating capacity was estimated at 361MW.
- The operating capacity results from a total of more than **11,940** individual renewable energy installations³.

This 508MW of total capacity is split between approximately:

- 301MW of electrical capacity (MWe).
- 199MW of thermal (heat) capacity (MWth).
- 7MW of combined heat and power (CHP) capacity.
- 2MW of capacity attributable to ‘unspecified’ technologies or energy categories^{4,5}.

¹ <http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/Communities>

² Every reasonable effort has been taken to identify operational renewable capacity in community or local ownership; however it is likely that some projects, particularly where planning permission is not required, will not be recorded in the database. Figures in this report are therefore presented as ‘minimum’ values.

³ This number of installations includes the total number of individual wind turbines in any multi-turbine development.

⁴ An ‘unspecified’ energy category refers to energy generated by energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.

⁵ Throughout this report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.

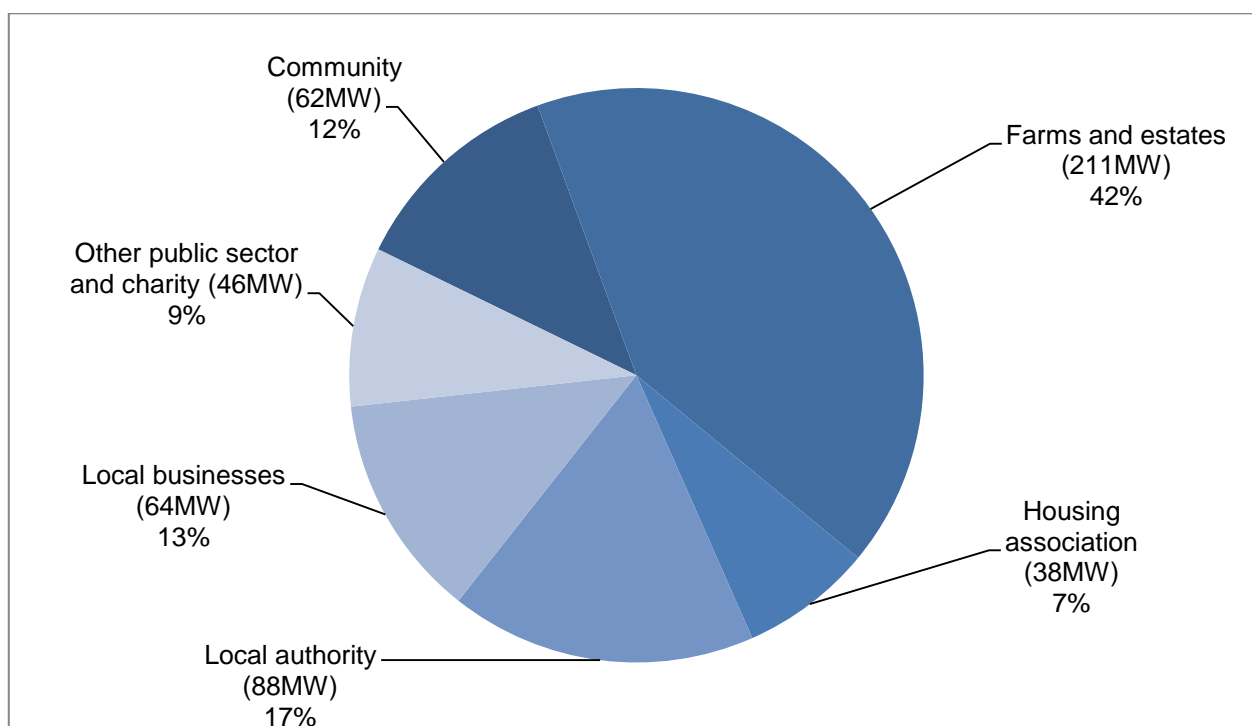
Over the course of a year, community and locally owned renewable energy installations identified here could be expected to produce around 1,281GWh of renewable energy, consisting of approximately:

- 720GWh of electricity.
- 516GWh of heat.
- 34GWh of combined heat and power generation.
- 11GWh of output from unspecified energy categories⁶.

An estimated 74MW of the capacity was in operation before June 2014, but had not been previously reported. A large proportion of this reported increase is due to an increase in the amount of data made available to the public from the Department of Energy and Climate Change and Ofgem.

The largest proportion of operational community and locally owned capacity is on Scottish farms and estates (211MW or 42%). Community groups own 12% of the total operational capacity (62MW). Since June 2014, the amount of operational capacity in local authority ownership has continued to grow. South Lanarkshire has seen the largest increase with over 10MW capacity from approximately 615 installations being added to the database since the last report.

Figure 1. Capacity of operational installations at September 2015, by ownership category



⁶ This 11GWh of output is from energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.

A further 609MW of community or locally owned renewable energy capacity is estimated to be in different stages of development. Of this 609MW:

- 79MW is under construction.
- 359MW has been granted planning permission but construction has not yet started ('consented not built')⁷.
- 84MW is waiting for a planning decision to be made ('in planning')⁸.
- 86MW is in the scoping stage.

Projects have been given an 'unknown' status when they are known to be in development but it has not been possible to establish what stage of the process they are at. For this report we have been able to attribute almost all projects to an appropriate stage by using planning information resources. Where there has been no evidence of a project having applied for planning permission, but there is evidence of the intent to take the project forward (for example in a carbon management plan), the project has been labelled as 'in scoping'. 0.08MW of capacity is currently recorded as having an unknown status. There is also approximately 1MW of capacity currently recorded as being 'non-operational'. For these projects, we have been informed that the construction of the installation is complete but that the installation is currently not operating.

The 359MW of 'consented not built' capacity includes the Viking Energy Wind Farm, which accounts for 167MW of community owned wind capacity in this stage of development. This project is currently scheduled to begin major construction works in 2017 and it is planned that it will be connected to the national grid in 2021⁹.

At the end of June 2014 there were 37 shared ownership projects, 24 of which were operational with the remaining 13 in various stages of development. The operational shared ownership projects account for 37MW of community and locally owned renewable capacity and the 'in development' shared ownership projects make up a further 183MW¹⁰.

Looking forward, the community and locally owned database will continue to be used to monitor progress beyond the 500MW target. The Scottish Government has made a commitment to review the target to ensure its support for community and local owned renewable energy is undiminished. A full update of the database will still be carried out annually, however updates on projects and new projects reported to the Energy Saving Trust will be added throughout the year. The database will also be used as the data source for the monthly update of the Local Energy Scotland community and locally owned renewable energy map¹¹.

⁷ Applies only to installations which require planning permission.

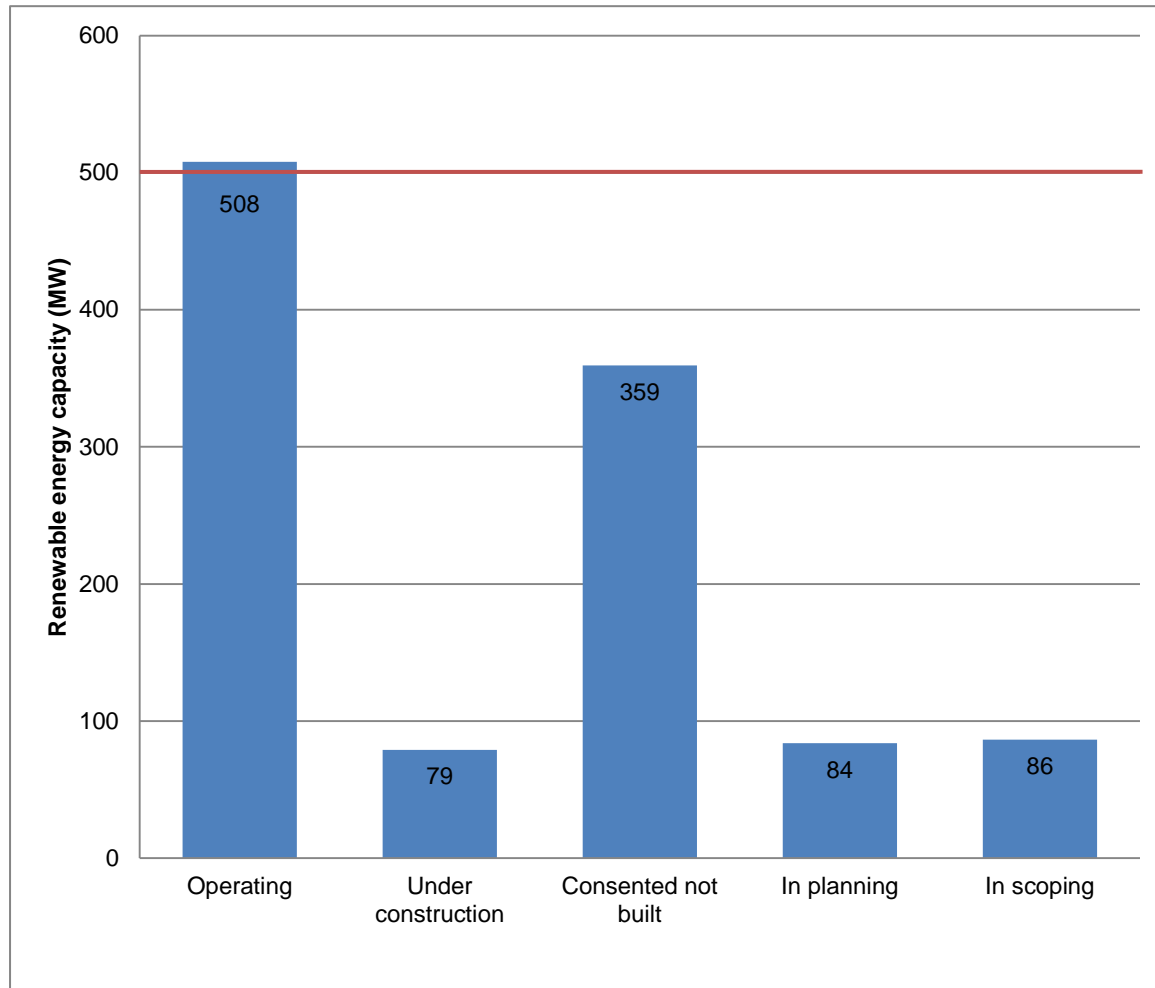
⁸ Applies only to installations which require planning permission.

⁹ <http://www.vikingenergy.co.uk/the-project>

¹⁰ This figure includes the Viking Energy Wind Farm, which itself totals 167MW of community or locally owned capacity.

¹¹ www.localenergyscotland.org/projects

Figure 2. Progress beyond the 2020 500MW community and locally owned renewable energy capacity target for all sectors and renewable technologies as at September 2015



2. Methodology summary

A full methodology is provided in appendix 1. The following section provides an overview of the main points.

2.1 Definition of ‘community and locally owned’

As with previous versions of the database, the Scottish Government has requested that ‘community and locally owned renewable energy’ be defined as technologies producing heat and/or electricity from a renewable source, where the owner of the installation is in one of the following categories:

- A community group.
- A local Scottish business¹².
- A farm or estate.
- A local authority.
- A housing association.
- ‘Other public sector and charity’, including:
 - Charities, including faith organisations.
 - Public bodies or publicly owned companies.
 - Further or higher education establishments such as universities and colleges.
 - Recipients of Scottish Community and Householder Renewables Initiative (SCHRI) grants under the community stream of the programme (but not recipients of grants under the householder stream)¹³.
 - Recipients of Community and Renewable Energy Scheme (CARES) grants¹⁴.

‘Ownership’ has not been restricted to cases where the organisation owns the entire renewable installation as it also includes cases where a community group or farmer has helped to meet part of the cost of developing and installing a renewables system in return for some benefit, such as a share in the income generated. In such cases, only the percentage of the installation’s capacity equal to the share owned by the community or local owner is counted towards the target.

‘Ownership’ does not include cases where the only benefit to the farmer or community group is a land rental payment from the owner or developer of the installation, or installations that generate community benefit payments but that are fully owned by another organisation (for example a utility company).

¹² Note that this excludes Scottish businesses whose main purpose is to develop renewable energy projects on land they do not fully own, at a site distant from their office.

¹³ Scheme funded by the Scottish Government which offered grants, advice and project support to assist the development of new community and household renewable energy schemes in Scotland.

¹⁴ Scheme currently funded by the Scottish Government to support the development of locally-owned renewable energy projects which provide wider community benefits.

2.2 Renewable energy technologies included

The following renewable energy technologies are included in the database:

- Wind (including wind to heat).
- Hydroelectric.
- Wave and tidal (marine).
- Solar photovoltaics (solar PV).
- Biomass (wood) primary combustion (including for district heating).
- Biomass (wood) gasification for the production of electricity and/or heat.
- Waste incineration (organic or putrescible fraction) for production of electricity and/or heat.
- Heat pumps (ground source, air source and water source) including air source heat pumps (ASHP) incorporating exhaust air heat recovery (EAHR).
- Solar thermal panels.
- Solar air/solar ventilation systems.
- Anaerobic digestion producing electricity and/or heat¹⁵.
- Landfill gas capture producing electricity and/or heat.

Full descriptions of these technologies are provided in appendix 2.

2.3 Approach taken and data sets used

The approach taken for data collection and processing for this version of the database and report was broadly in line with the approach taken for the previous reports. A full methodology is provided in appendix 1 and the main changes to this year's data collection process are outlined below.

For this year's report, a full database update was carried out for data correct as of June 2015. The data collection period was then extended for three months to include data received until the end of September 2015.

This year new survey layouts were introduced for local authorities and housing associations. This simplified the process of returning information and improved the quality of data returned. The survey of housing association renewables was distributed by the Scottish Federation of Housing Associations on behalf of the Energy Saving Trust.

A list of the main data sources used, and the organisations that provided them, is given in appendix 3.

¹⁵ Excludes the heat produced only for maintenance of the digestion process.

2.4 Information collected

Wherever possible, the information collected for each installation included:

- Name of the project.
- Ownership (organisation and type of organisation).
- Where appropriate, the name of the subsidiary trading company owning the renewable technology on behalf of the community group/charity.
- Location, including local authority area, address and a postcode and/or grid reference.
- Technology type.
- Number and installed capacity of the technology.
- Operational status as at September 2015 (operating/under construction/consented not built/in planning/in scoping/planning not granted/non-operational/decommissioned).
- The date on which generation commenced (for operational projects).
- Percentage ownership by the community group etc., in cases where the organisation did not have full ownership of the installation.
- Where appropriate, the building type associated with the renewable energy installation.
- Whether public grant or loan funding was received.

3. Community and locally owned renewable energy operational in 2015

3.1 Results for September 2015: operational capacity

At the end of September 2015, an estimated minimum 508MW of community or locally owned renewable energy capacity was operational in Scotland, spread over a total of 11,940¹⁶ individual renewable energy installations.¹⁷

A breakdown of operational capacity by ownership categories is given in table 1 and illustrated in figure 3. The largest proportion of operational capacity is on Scottish farms and estates (211MW, or 42%). Community groups own 12% of total operational capacity (62MW).

The largest numbers of individual installations (more than 10,100) are in local authority and housing association ownership, together accounting for 85% (by number) of individual installations. Housing associations are the owners of the largest number of individual installations, at around 6,440 (over 50% of all individual installations recorded). The number of local authority installations now recorded is approximately 3,730, which is an increase of over 1,100 on last year. Domestic heat pumps are the most used technology for both local authorities and housing associations, accounting for approximately 5,000 of the 10,170 installations in these ownership categories. Solar PV and solar thermal installations make up the majority of the remaining systems¹⁸.

Table 1. Estimated number and capacity of operational installations as of September 2015 by ownership category

<u>Ownership category</u>	<u>Operating capacity</u>	<u>% of operating capacity</u>	<u>Number of operating installations¹⁹</u>	<u>% of operating installations</u>
Community	62MW	12%	490	4%
Farms and estates	211MW	42%	460	4%
Housing association	38MW	7%	6,440	54%
Local authority	88MW	17%	3,730	31%
Local businesses	64MW	13%	440	4%
Other public sector and charity	46MW	9%	380	3%
TOTAL²⁰	508MW	100%	11,940	100%

¹⁶ Figure rounded to the nearest 10.

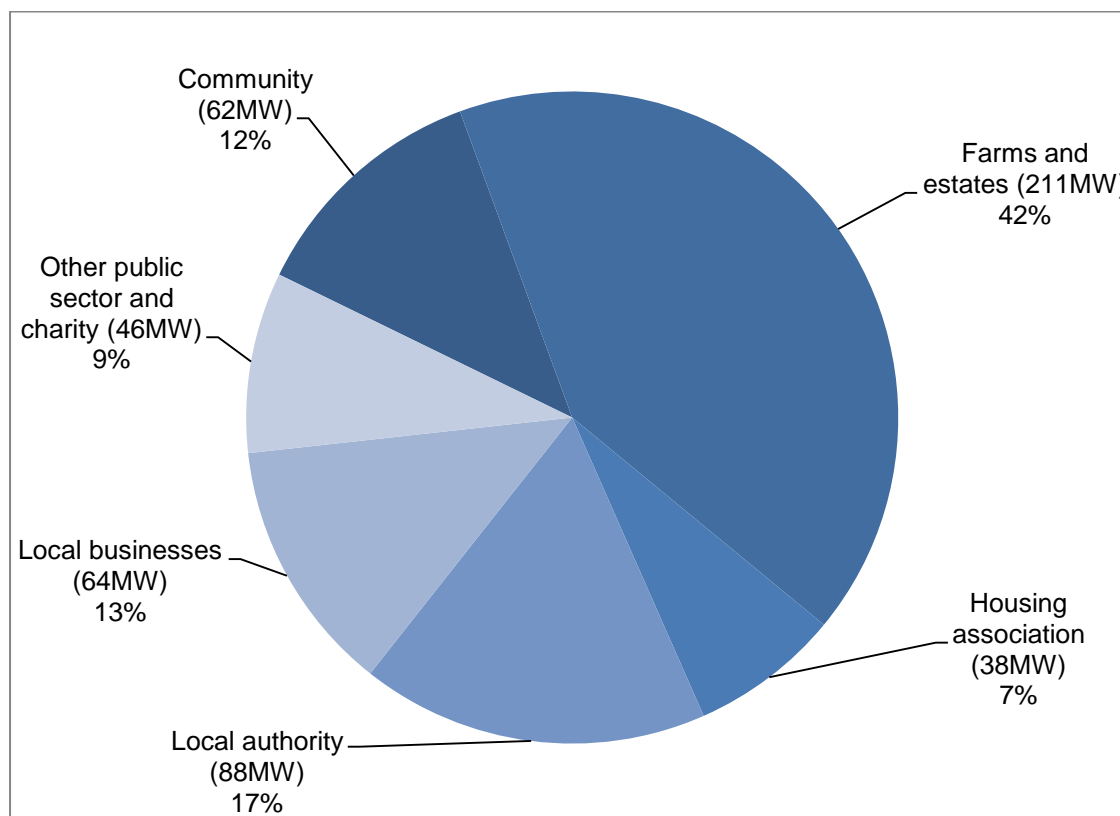
¹⁷ This number of installations includes the total number of individual wind turbines in any multi-turbine development.

¹⁸ All installation figures in this paragraph are rounded to the nearest 10.

¹⁹ Rounded to the nearest 10; for wind farms, each turbine is counted as one installation.

²⁰ Throughout this report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.

Figure 3. Capacity of operational installations as of September 2015 by ownership category



The majority of capacity in operation as of September 2015 was from wind turbines, at 245MW. The second largest category was energy from biomass (wood), at 138MW. These two technologies account for 75% of operational capacity as of September 2015. A breakdown by technology type is given in table 2 and illustrated in figure 4.

Table 2. Number and capacity of operational installations as of September 2015, by technology

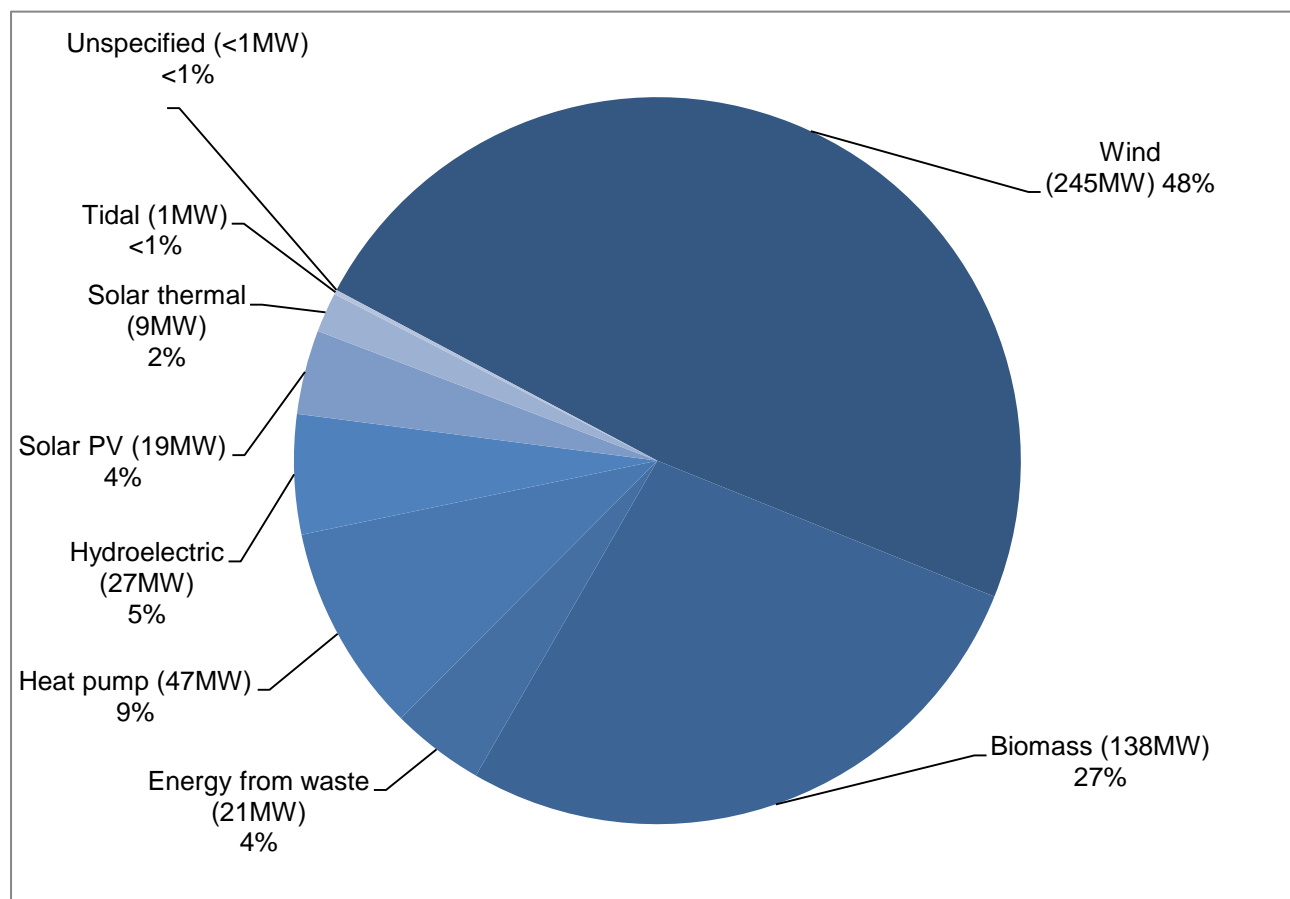
<u>Technology</u>	<u>Operating capacity</u>	<u>% of operating capacity</u>	<u>Number of operating installations²¹</u>	<u>% of operating installations</u>
Wind	245MW	48%	600	5%
Biomass	138MW	27%	710	6%
Energy from waste	21MW	4%	20	<1%
Heat pump	47MW	9%	5240	44%
Hydroelectric	27MW	5%	130	1%
Solar PV	19MW	4%	2930	25%
Solar thermal	9MW	2%	2300	19%
Tidal	1MW	<1%	2	<0.1%
Unspecified ²²	<1MW	<1%	3	<0.1%
TOTAL²³	508MW	100%	11940	100%

²¹ Rounded to the nearest 10 unless there are less than 10 installations within the database; for wind farms, each turbine is counted as one installation.

²² 'Unspecified' technologies are those where the existence of a renewable technology in community or local ownership is known but the technology type has not been provided to the Energy Saving Trust. Whilst the majority of 'unspecified' technologies reported as being in operation are known to be solar installations, the type of solar technology has not been provided.

²³ Throughout the report, data has been rounded for ease of reading, hence some sub-totals may not precisely equal summed figures.

Figure 4. Capacity of operational installations as of September 2015 by technology type



The difference between those organisations which own the majority of installations, and those owning the majority of operating capacity, stems from the mix of renewable technologies found in the different ownership categories. Housing associations own large numbers of solar thermal panels, solar PV panels and heat pumps. However, as the majority of these are on individual domestic properties, each individual installation typically has a small capacity.²⁴ Housing associations thus have a relatively small share (about 7%) of Scotland's total operating community and locally owned renewable capacity, despite owning over 50% of all operating installations.

The amount of operational capacity in local authority ownership has continued to grow, increasing from 57MW in last year's report²⁵ to 88MW as of September 2015. While Highland council continues to hold the largest share of local authority owned renewable energy capacity, South Lanarkshire has seen the largest increase with over 10MW from approximately 615 installations being added to the

²⁴ Typical domestic solar thermal panel size is around 4m², or about 2.38kWth (0.00238MWth). Solar PV panel size is around 3.4m², or around 2.8KWe (0.0028MWe). Domestic heat pumps in housing association homes are typically around 7kWth (0.007MWth), or 4.5kWth (0.0045MWth) for an ASHP with exhaust air heat recovery. See appendix 4 for more details.

²⁵ Reported as of June 2014. <http://www.energysavingtrust.org.uk/reports/community-and-locally-owned-renewable-energy-scotland-2014>

database since the previous update. Of these 10MW of capacity, approximately 6MW are now known to have been operational for several years. This reflects an increase in quantity and quality of information returned following this year's local authority survey.

South Lanarkshire, Stirling and Fife councils have the highest numbers of installations, with 975, 755 and 525²⁶ individual installations respectively. The majority of these are heat pump, solar PV and solar thermal installations. A more detailed breakdown of operational capacity, number of installations and technology type can be seen in figure 9, and in tables 3 and 4.

²⁶ Figures are rounded to the nearest 5.

Table 3: Operational capacity in local authority ownership by technology²⁷ and area²⁸, September 2015

<u>Local authority</u>	<u>Biomass</u>	<u>Energy from waste</u>	<u>Heat pump</u>	<u>Solar PV</u>	<u>Solar thermal</u>	<u>Wind</u>	<u>Total</u>
Highland	14MW	-	<1MW	<1MW	<1MW	<1MW	15MW
South Lanarkshire	7MW	-	6MW	<1MW	<1MW	<1MW	14MW
Dundee City	-	7MW	<1MW	<1MW	<1MW	-	7MW
Fife	<1MW	5MW	<1MW	<1MW	1MW	<1MW	7MW
Perth and Kinross	6MW	-	<1MW	-	<1MW	-	6MW
North Lanarkshire	2MW	1MW	<1MW	1MW	<1MW	<1MW	4MW
West Dunbartonshire	-	-	4MW	-	-	-	4MW
Moray	<1MW	-	3MW	<1MW	<1MW	<1MW	3MW
Aberdeenshire	3MW	-	<1MW	<1MW	<1MW	<1MW	3MW
Stirling	<1MW	<1MW	<1MW	3MW	<1MW	<1MW	3MW
East Ayrshire	2MW	-	<1MW	<1MW	-	<1MW	2MW
Orkney Islands	-	-	2MW	<1MW	<1MW	<1MW	2MW
Argyll and Bute	1MW	-	<1MW	1MW	-	<1MW	2MW
North Ayrshire	1MW	-	-	1MW	<1MW	<1MW	2MW
Dumfries and Galloway	1MW	-	<1MW	1MW	<1MW	-	2MW
All other areas²⁹	6MW	<1MW	2MW	1MW	1MW	2MW	12MW
Total	43MW	13MW	17MW	9MW	3MW	2MW	88MW

²⁷ Hydroelectric and unspecified technology capacities and are not shown for ease of display; Shetland has one hydroelectric system (0.016MW) and there is 0.02MW of 'unspecified' operational capacity. These figures in particular have been omitted due to their small impact on the overall figures displayed.

²⁸ Only the top 15 local authority areas (by operational capacity) have been shown in detail for ease of display.

²⁹ Angus, Glasgow City, Scottish Borders, City of Edinburgh, Aberdeen City, Western Isles, Inverclyde, Midlothian, Renfrewshire, West Lothian, Clackmannanshire, Shetland Islands, South Ayrshire, East Renfrewshire, Falkirk, East Lothian, East Dunbartonshire .

Table 4. Number of operational systems in local authority ownership by technology³⁰ and area³¹, September 2015³²

<u>Local authority</u>	<u>Biomass</u>	<u>Energy from waste</u>	<u>Heat pump</u>	<u>Solar PV</u>	<u>Solar thermal</u>	<u>Wind</u>	<u>Total</u>
South Lanarkshire	50	-	900	20	10	<5	975
Stirling	5	<5	<5	730	15	<5	755
Fife	5	5	30	55	425	5	525
Moray	<5	-	445	<5	25	<5	470
Orkney Islands	-	-	100	75	<5	15	195
Midlothian	<5	-	-	<5	150	-	155
Highland	70	-	20	45	10	<5	150
Angus	5	-	15	<5	55	<5	80
North Lanarkshire	5	<5	5	20	5	<5	35
Dumfries and Galloway	5	-	<5	20	5	-	35
Edinburgh, City of	5	-	-	-	25	<5	30
Clackmannanshire	-	-	10	10	10	<5	25
Argyll and Bute	5	-	5	20	-	<5	25
North Ayrshire	5	-	-	15	5	<5	25
Western Isles	-	<5	10	5	5	5	25
All other areas³³	25	<5	60	70	30	25	210
Total	190	10	1,590	1,090	775	65	3,720

³⁰ Hydroelectric and unspecified technology capacities and are not shown for ease of display; Shetland has one hydroelectric system (0.016MW) and there are two installations with 'unspecified' technologies in Fife and Midlothian.

³¹ Only the top 15 local authority areas (by number of installations) have been shown for ease of display.

³² All figures shown are to the nearest 5.

³³ Aberdeenshire, West Lothian, Renfrewshire, Aberdeen City, Falkirk, Shetland Islands, East Ayrshire, Dundee City, Perth and Kinross, Inverclyde, Glasgow City, East Lothian, Scottish Borders, South Ayrshire, East Renfrewshire, East Dunbartonshire, West Dunbartonshire.

For farms and estates, wind turbines and biomass boilers are the main renewable technologies owned. Installations of biomass boilers and wind turbines on farms and estates typically have very large capacities³⁴, leading to farms and estates owning the largest share of installed operational capacity as of September 2015 (with 42% of the total operational capacity) despite only owning 4% of all installations. An increase in the number of hydroelectric installations has also contributed to the high proportion of operational capacity held by farms and estates. The number of hydroelectric installations has doubled since last year, with approximately 130 installations now in operation, with farms and estates owning 55% of these installations.

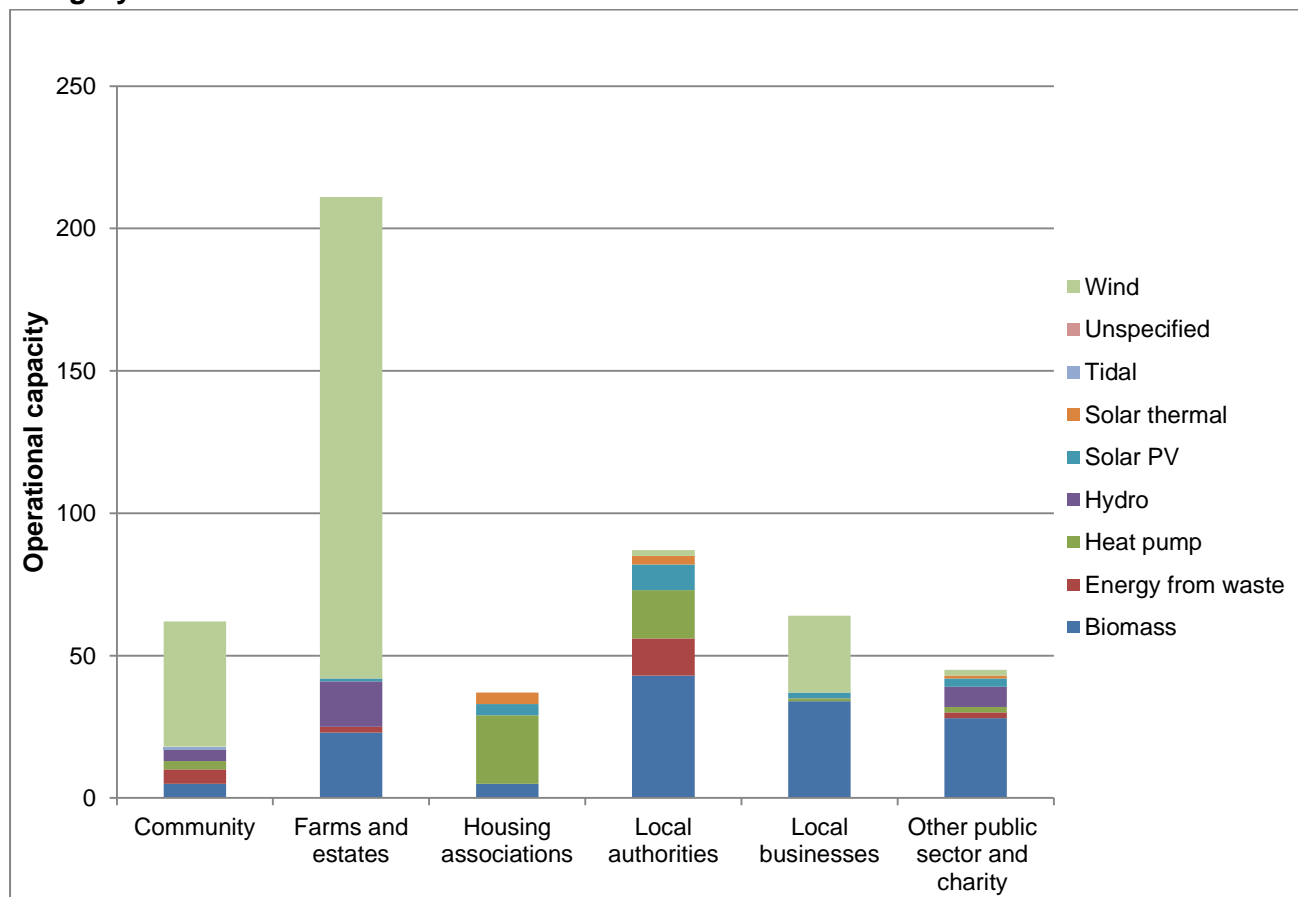
A breakdown of operational capacity by technology and by ownership category is given in table 5 and illustrated in figure 5.

Table 5. Operational capacity as of September 2015, by technology and ownership category

<u>Technology</u>	<u>Community</u>	<u>Farms and estates</u>	<u>Housing associations</u>	<u>Local authorities</u>	<u>Local businesses</u>	<u>Other public sector and charity</u>
Wind	44MW	169MW	<1MW	2MW	27MW	2MW
Biomass	5MW	23MW	5MW	43MW	34MW	28MW
Energy from waste	5MW	2MW	<1MW	13MW	<1MW	2MW
Heat pump	3MW	<1MW	24MW	17MW	1MW	2MW
Hydroelectric	4MW	16MW	-	<1MW	<1MW	7MW
Solar PV	<1MW	1MW	4MW	9MW	2MW	3MW
Solar thermal	<1MW	<1MW	4MW	3MW	<1MW	1MW
Tidal	1MW	-	-	-	-	-
Unspecified	-	-	-	<1MW	-	-
TOTAL	62MW	211MW	38MW	88MW	64MW	46MW

³⁴ Farm and estate biomass (wood) heating systems sizes range between 26kW and 1.6MW, with over half of the projects having a capacity of between 100kWth and 220kWth. See appendix 4 for more details. Farm and estate wind turbines varied greatly in size, from 1kWe (0.001MWe) to 2.5MWe (2,500kWe), however most were over 300kWe (0.3MWe) in size.

Figure 5. Operational capacity as of September 2015 showing technology by ownership category



3.2 Estimate of yearly energy produced based on installed capacity - September 2015

Over a year the 508MW of operational community and locally owned renewable energy capacity could be expected to produce up to 1,281GWh of renewable energy, consisting of around 720GWh of electricity; 516GWh of heat; 34GWh of energy from combined heat and power installations; and 11GWh of 'unspecified' energy³⁵. A breakdown by ownership category is given in table 6. The assumptions used to calculate yearly output are specific to each technology and are detailed in appendix 1.

³⁵ This 11GWh of output is from energy from waste projects where the energy output (electricity/heat/combined heat and power) is unknown.

Table 6. Estimated capacity and annual energy output of operational installations at September 2015 by ownership category

<u>Ownership category</u>	<u>Operating capacity</u>	<u>% of operating capacity</u>	<u>Estimated yearly energy output</u>	<u>% of output</u>
Community	62MW	12%	145GWh	11%
Farms and estates	211MW	42%	532GWh	42%
Housing association	38MW	7%	82GWh	6%
Local authority	88MW	17%	208GWh	16%
Local businesses	64MW	13%	201GWh	16%
Other public sector and charity	46MW	9%	112GWh	9%
TOTAL	508MW	100%	1,281GWh	100%

3.3 Maps of operating capacity by ownership category

The following maps (figures 6 to 11) illustrate the distribution of operational community and locally owned renewable energy capacity throughout Scotland at September 2015, by ownership category.

Each circle indicates the location of a renewable energy installation, or installations if there is more than one system (of the same technology) owned by the same organisation at the same postcode or grid reference. The size of each circle indicates the capacity of the installation in MW, and the colour indicates the technology type. In cases where less than 100% of the installation is owned by a community or local owner, the size of the circle indicates the renewable capacity owned by the community or local owner, rather than the full size of the installation. Please note, these maps show only 98% of the operational renewable energy installations held in the database, as postcodes or grid references could not be obtained for the remaining 2% of installations.

Figure 6

Known operational renewable energy installations owned by Scottish community groups, as at September 2015

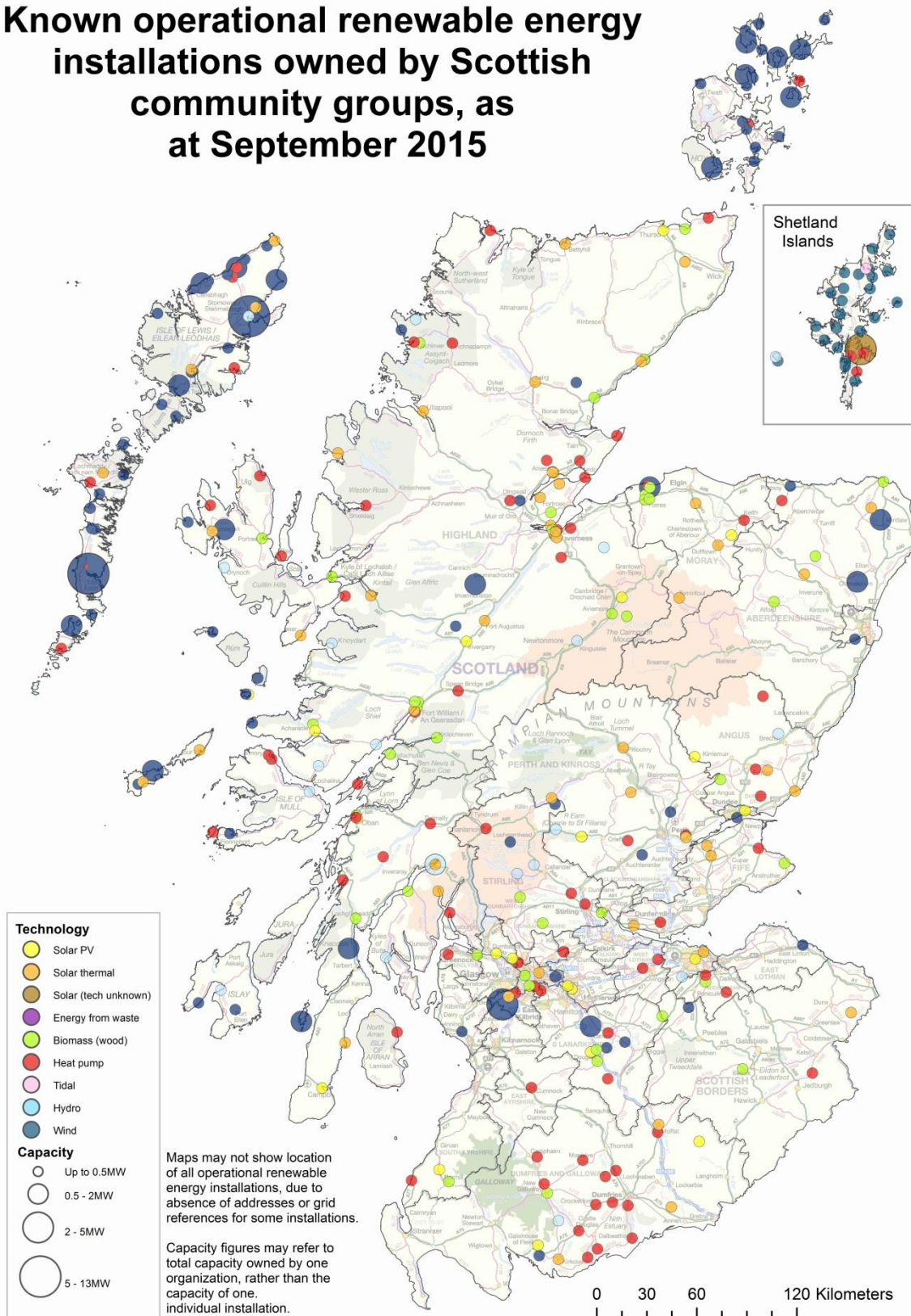


Figure 7

Known operational renewable energy installations owned by Scottish farms and estates, as at September 2015

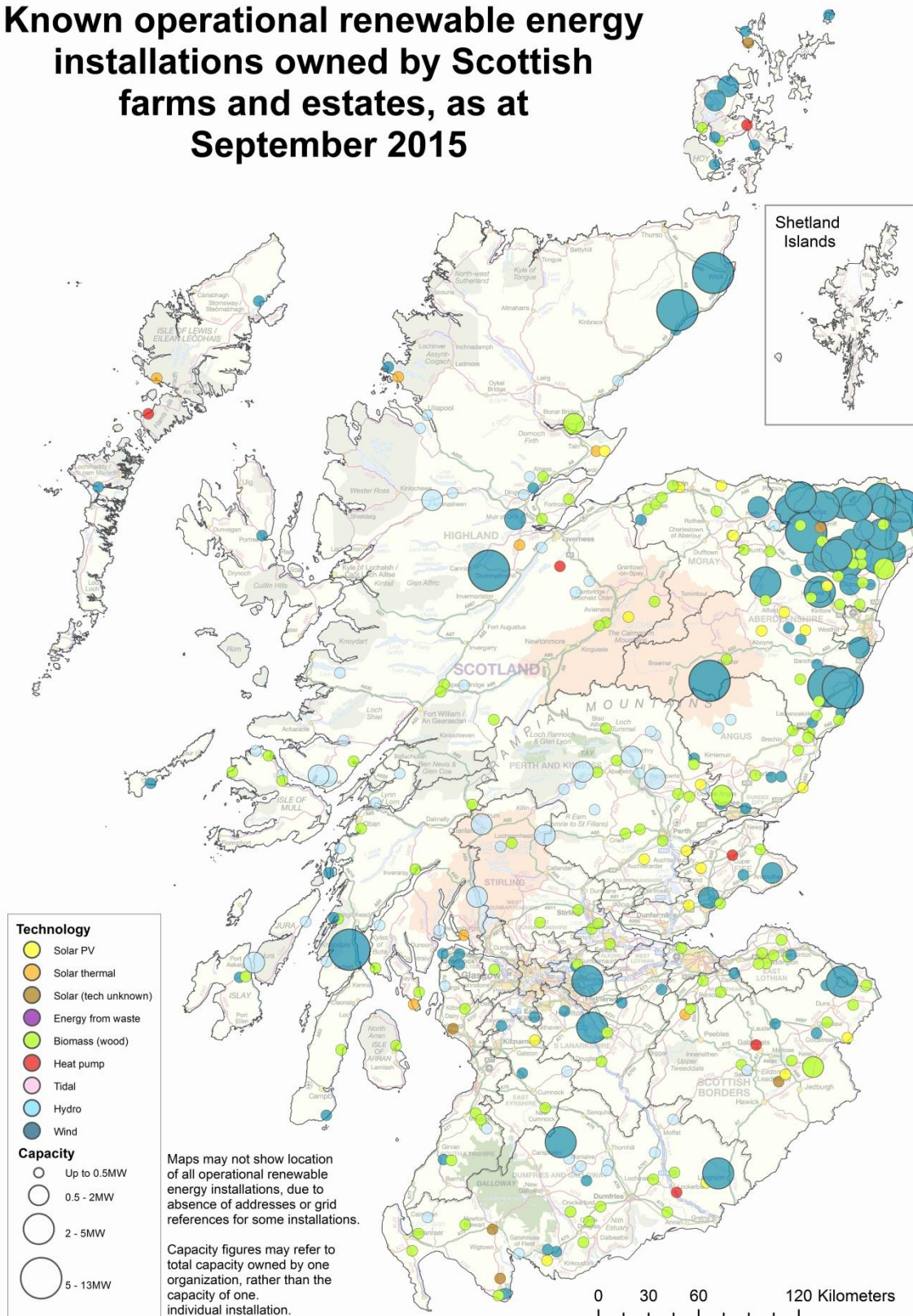


Figure 8

Known operational renewable energy installations owned by Scottish housing associations, as at September 2015

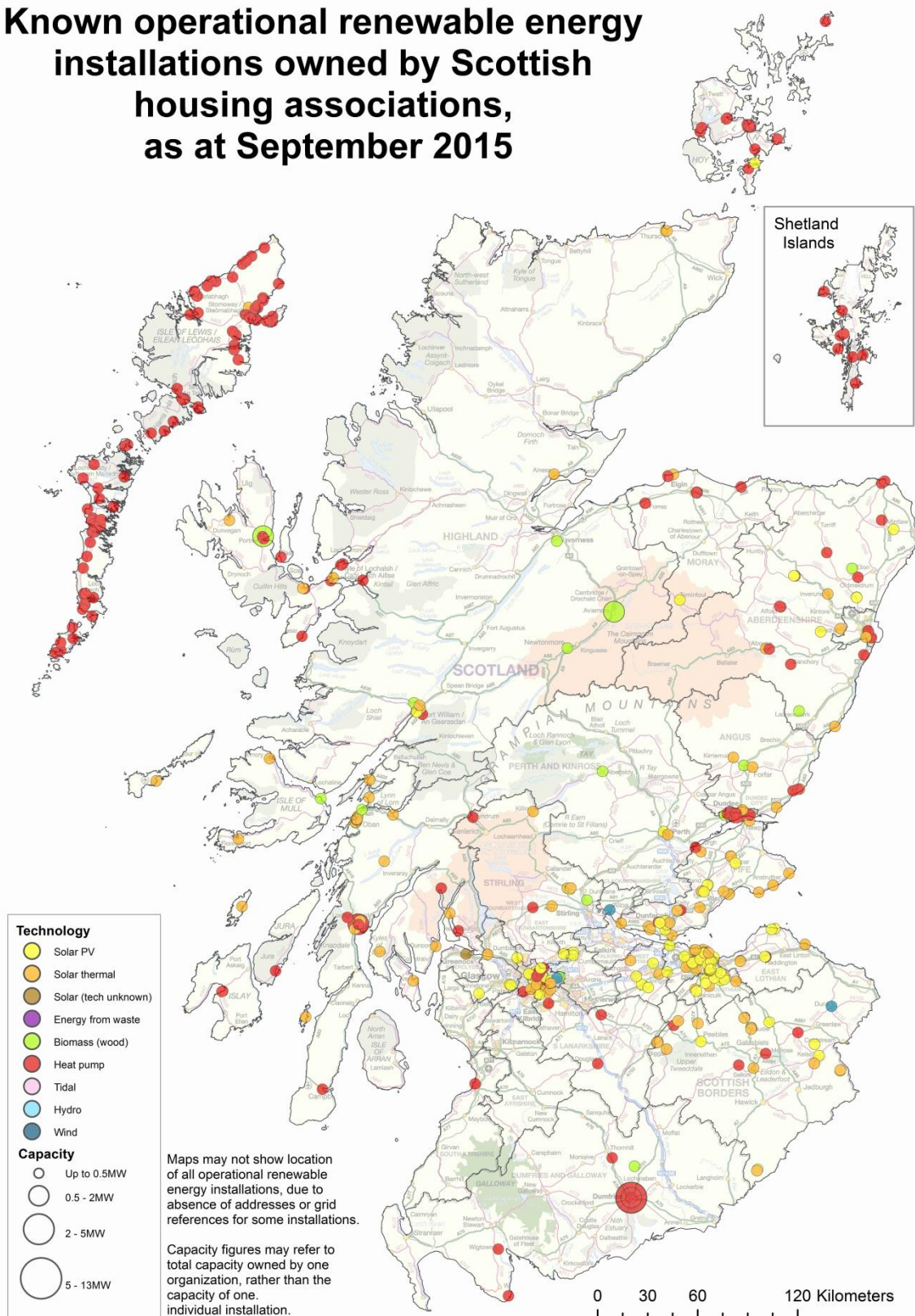


Figure 9

Known operational renewable energy installations owned by Scottish local authorities, as at September 2015

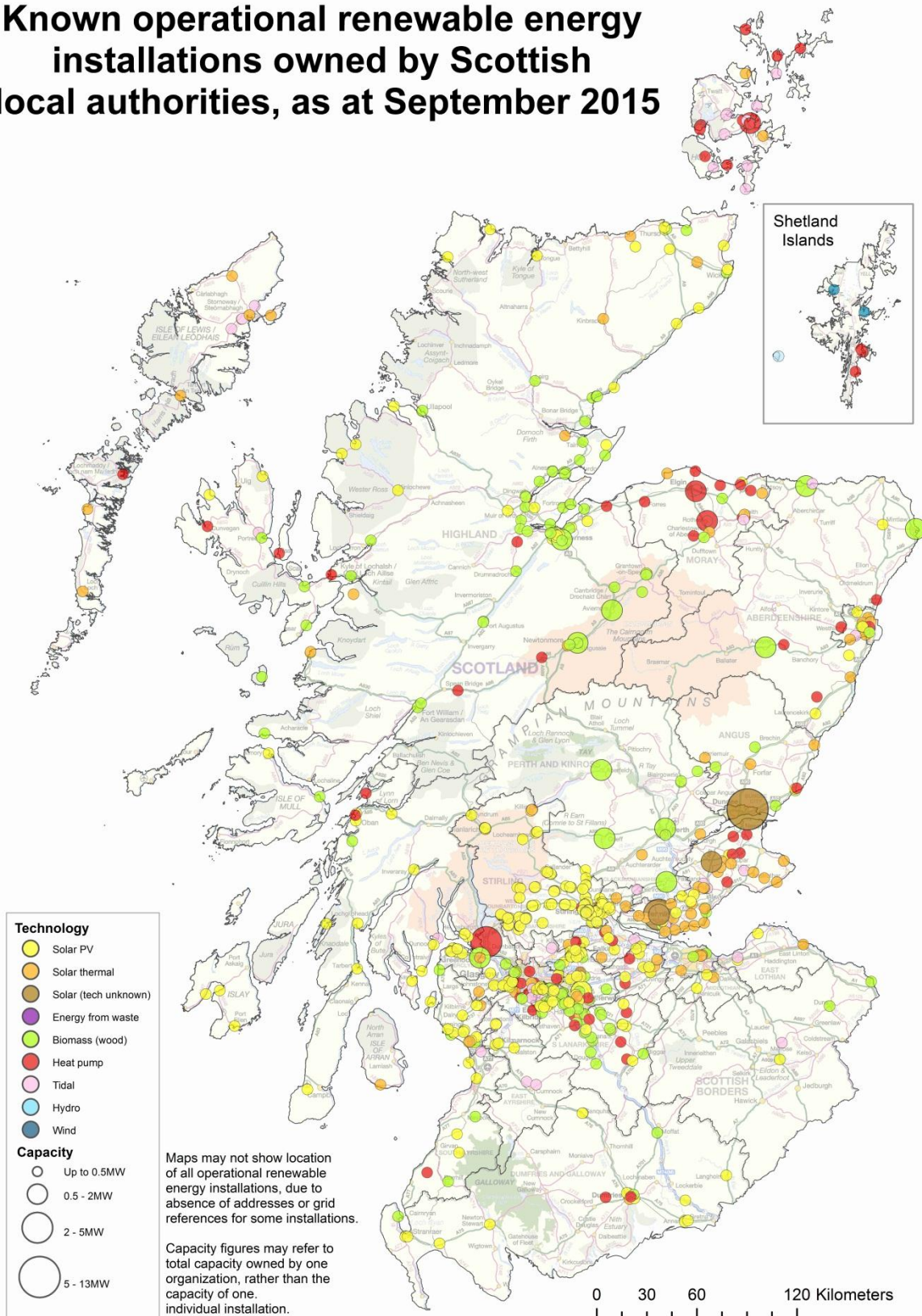


Figure 10

Known operational renewable energy installations owned by Scottish businesses, as at September 2015

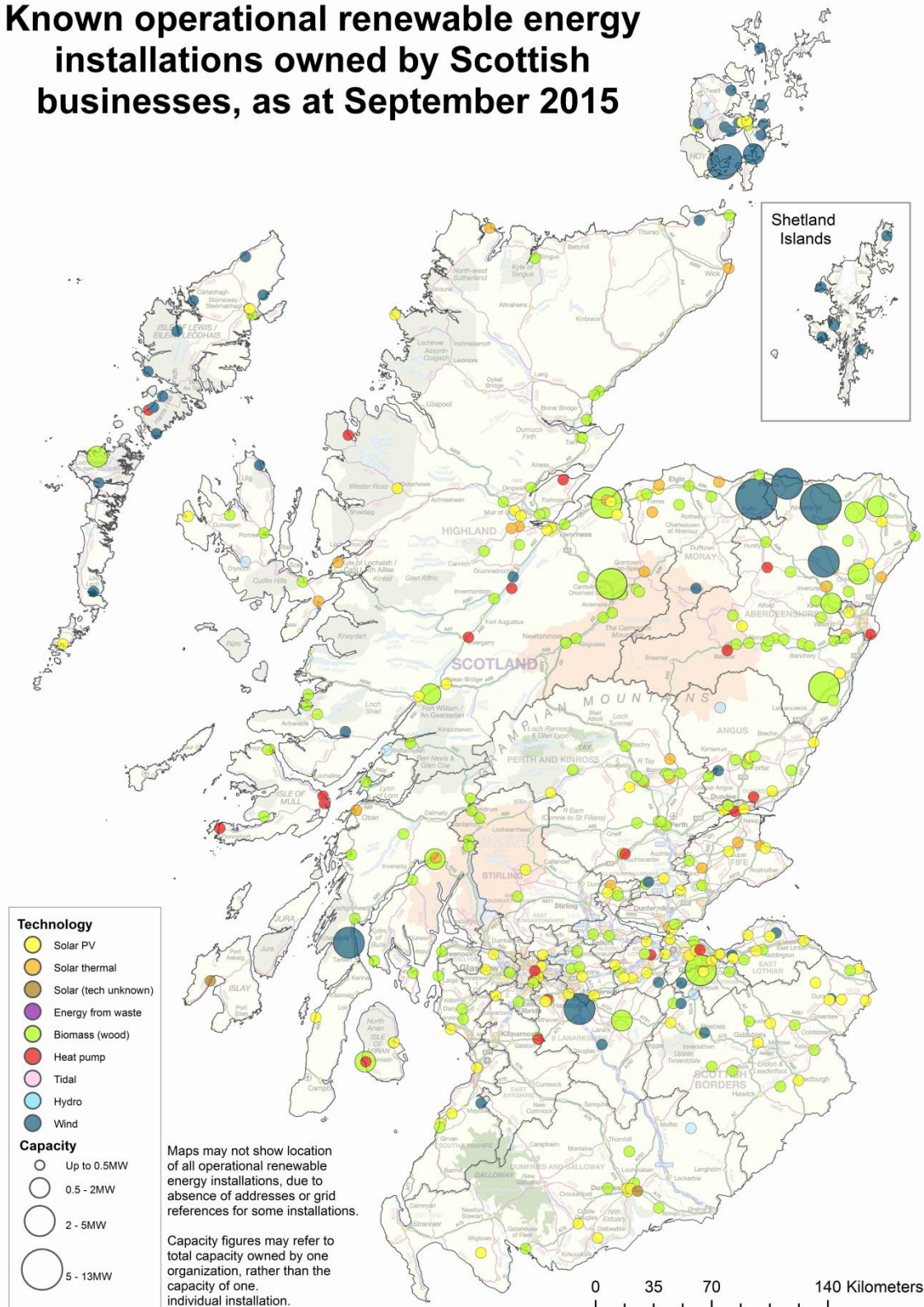
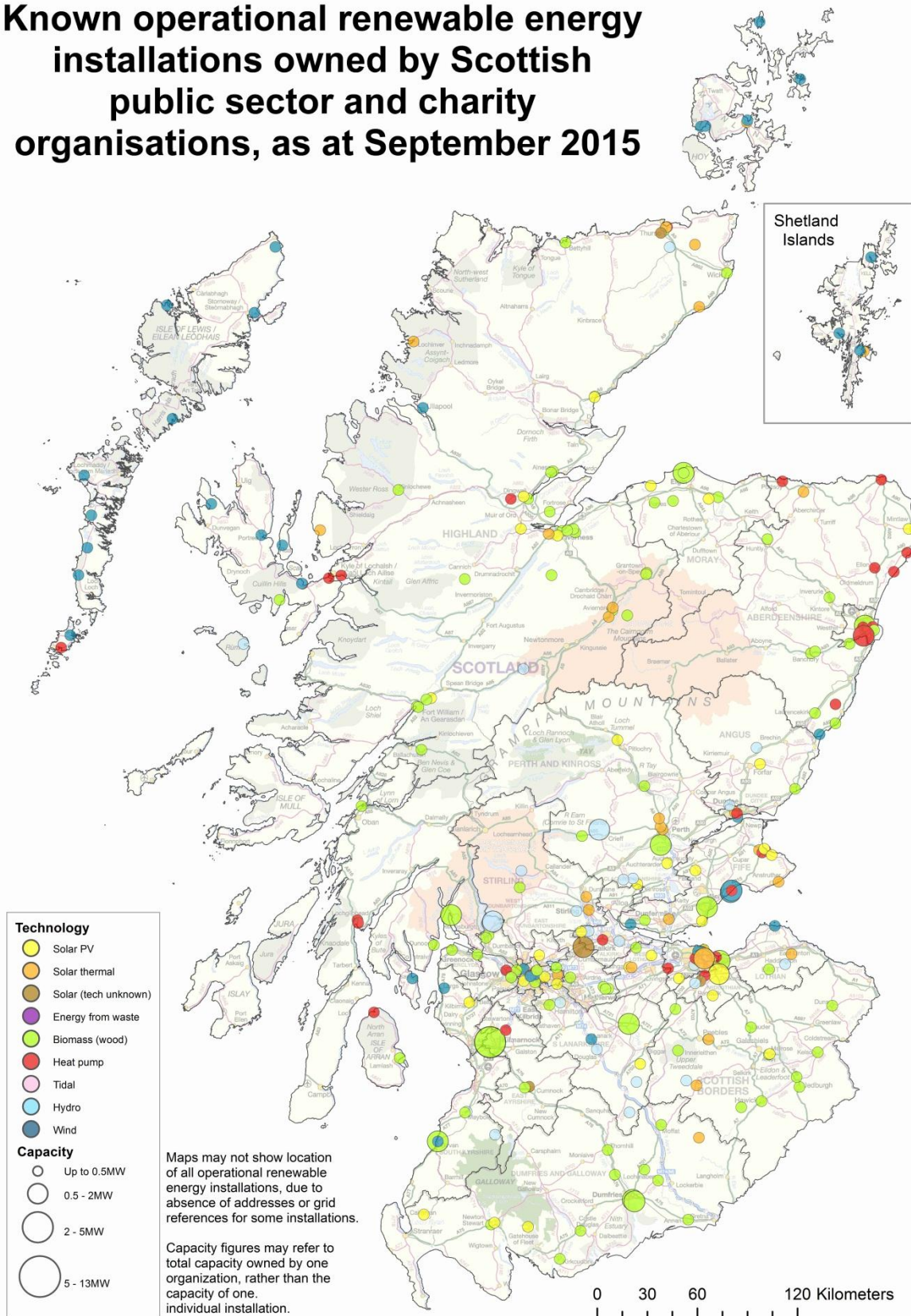


Figure 11

Known operational renewable energy installations owned by Scottish public sector and charity organisations, as at September 2015



4. Further community and locally owned renewable energy capacity in development

4.1 Progress beyond the 2020, 500MW target

In addition to the 508MW of community and locally owned renewable energy capacity estimated to be operational at the end of September 2015, a further 609MW of community or locally owned renewable energy capacity is estimated to be in various stages of development (under construction/consented but not built/in planning/in scoping), consisting of around 4,170 individual installations³⁶. There is also approximately 1MW of installed non-operational capacity³⁷.

Of the renewable energy capacity still in development, 79MW is under construction; 359MW³⁸ has been granted planning permission but construction has not yet started ('consented not built')³⁹; 84MW is in the planning system waiting for a planning decision to be made ('in planning')⁴⁰; and a further 86MW is being considered, or is at the stage where preparation is being made to apply for planning permission ('in scoping'). About 0.08 MW of capacity in the database is unclear in terms of development stage. This breakdown is illustrated in figure 12, and a breakdown by technology type is given in table 7.

Table 7. Estimated capacity in development as of September 2015 by development stage and technology

<u>Technology</u>	<u>Under construction</u>	<u>Consented, not built</u>	<u>In planning</u>	<u>In scoping</u>
Wind	47MW	297MW	57MW	53MW
Biomass	21MW	12MW	11MW	7MW
Energy from waste	2MW	3MW	<1MW	-
Heat pump	1MW	2MW	2MW	9MW
Hydroelectric	4MW	15MW	2MW	9MW
Solar PV	3MW	30MW	11MW	7MW
Solar thermal	1MW	1MW	<1MW	<1MW
Tidal	-	-	-	1MW
TOTAL	79MW	359MW	84MW	86MW

³⁶ This number of installations includes the total number of individual wind turbines in any multi-turbine development.

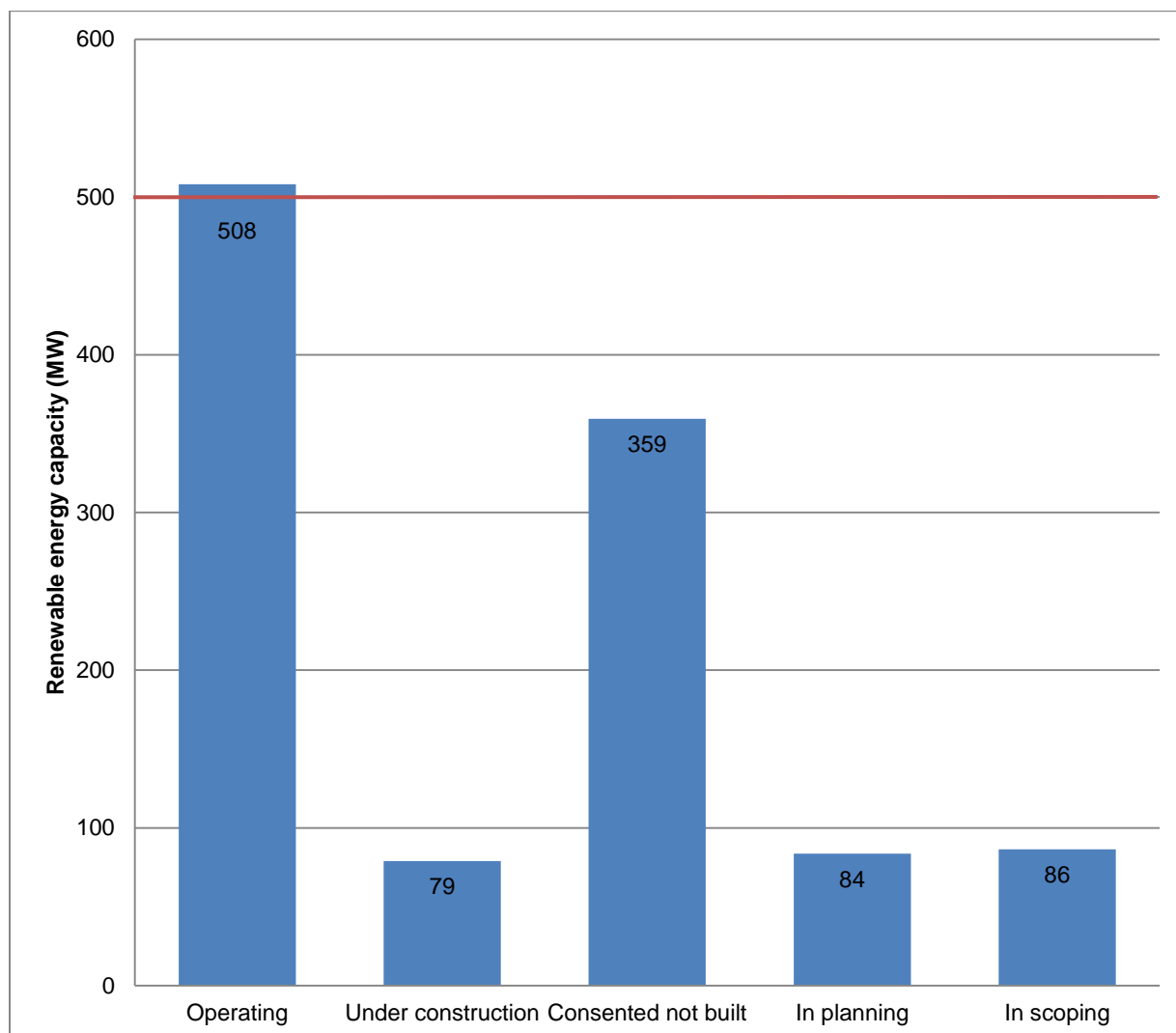
³⁷ The majority of the 'non-operational' capacity is made up of a number of local authority owned solar PV systems which have been installed but are not yet in use and biomass boilers which have failed and are awaiting repair or replacement.

³⁸ Of the 359MW community and locally owned renewable energy capacity that had been granted planning permission but construction had not yet started as of September 2015, 167MWe is the Shetland Charitable Trust's portion of the Viking wind farm, which has now been approved. <http://www.vikingenergy.co.uk/>

³⁹ Applies only to installations which require planning permission.

⁴⁰ Applies only to installations which require planning permission.

Figure 12. Progress beyond the 2020 500MW target for community and locally owned renewable energy capacity for all sectors and renewable technologies as at September 2015



4.2 Shared ownership projects

There are a number of projects where the ownership of a project is either shared between a community or local owner and a developer, or where multiple community or local owners have come together to share ownership. As of September 2015, there were 37 unique projects with shared ownership recorded in the database. Of these 37 projects, 5 were in shared ownership with other community or local project partners. 24 of these 37 projects were operational as of September 2015 and accounted for 37MW of community and locally owned capacity between them. The remaining 15 projects are in various stages of development and account for 183MW of the in development capacity. This figure includes the 167MW attributable to the Viking Energy Wind Farm which is still in the 'consented, not built' phase of development. 17 of the 37 projects have at least one project

partner in the 'communities' category (see Appendix 2 for a description of this category). Tables 8 to 10 show this breakdown in more detail.

The 'number of records' and 'number of projects' stated in tables 8 and 9 differ as each 'community or local' owner (see appendix 1 for ownership category descriptions) is recorded individually. This is to allow for appropriate allocation of capacity between the ownership categories.

Table 8. Number of records in the database reported as having shared ownership of a community or local renewable energy project, by category and status

<u>Category</u>	<u>Operating</u>	<u>Under construction</u>	<u>Consented, not built</u>	<u>In planning</u>	<u>In scoping</u>	<u>Total</u>
Community	10	2	4	-	1	17
Farms and estates	5	1	2	-	-	8
Housing association	10	1	1	1	1	14
Local authority	2	-	-	-	-	2
Local businesses	1	-	1	-	-	2
Other public sector and charity	-	-	1	-	-	1
TOTAL	28	4	9	1	2	44

Table 9. Number of projects that are recorded as having shared ownership, where at least one owner is a community group or local organisation by status

<u>Category</u>	<u>Number of projects</u>
Operating	24
Under construction	2
Consented, not built	8
In planning	1
In scoping	2
TOTAL	37

Table 10. Capacity of community or locally owned renewables projects in shared ownership, by category and status⁴¹

<u>Category</u>	<u>Operating</u>	<u>Under construction</u>	<u>Consented, not built</u>	<u>In planning</u>	<u>In scoping</u>	<u>Total</u>
Community	9MW	1MW	167MW	-	<1MW	178MW
Farms and estates	20MW	5MW	5MW	-	-	31MW
Housing association	2MW	3MW	1MW	<1MW	<1MW	5MW
Local authority	3MW	-	-	-	-	3MW
Local businesses	4MW	-	<1MW	-	-	4MW
Other public sector and charity	-	-	<1MW	-	-	<1MW
TOTAL	37MW	9MW	174MW	<1MW	<1MW	221MW

4.3 Assessing future progress beyond 500MW

The Energy Saving Trust has been compiling the community and locally owned renewables in Scotland database, and accompanying report, since 2011. In this time valuable information has been gathered that already gives a strong indication of the growth in community and locally owned renewable energy generation, as demonstrated by figures 13 and 14.

⁴¹ Capacity in this table has not been double counted as only the capacity attributable to the respective project partner is reported. Data has been rounded for ease of reading, hence some sub -totals may not precisely equal summed figures.

Figure 13. Operational capacity increase from June 2011 to September 2015, by ownership category⁴²

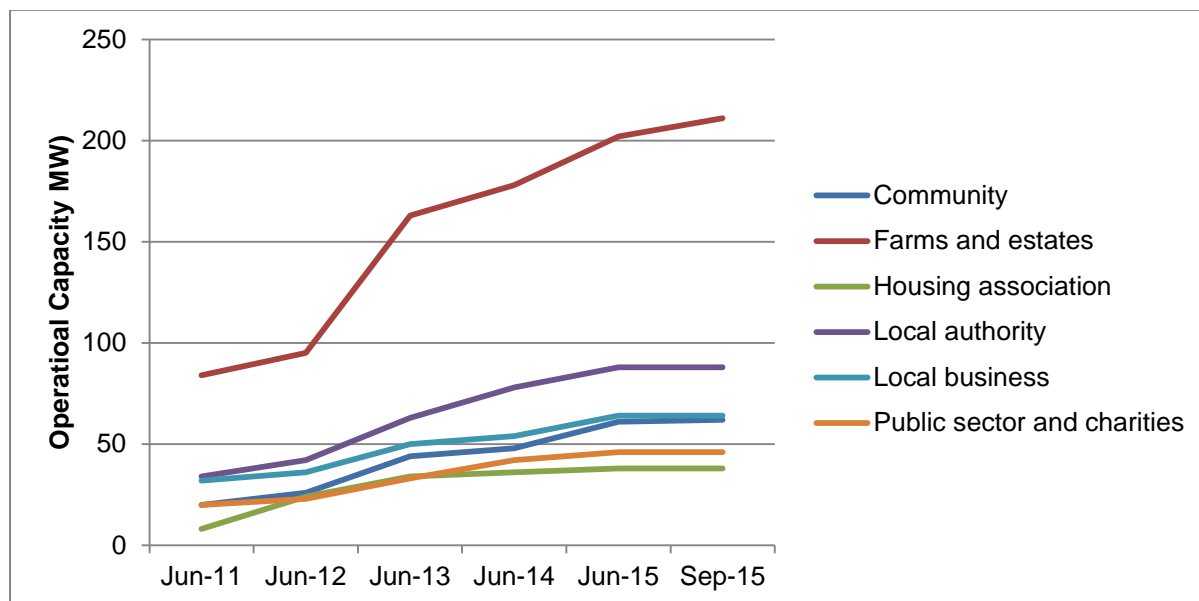
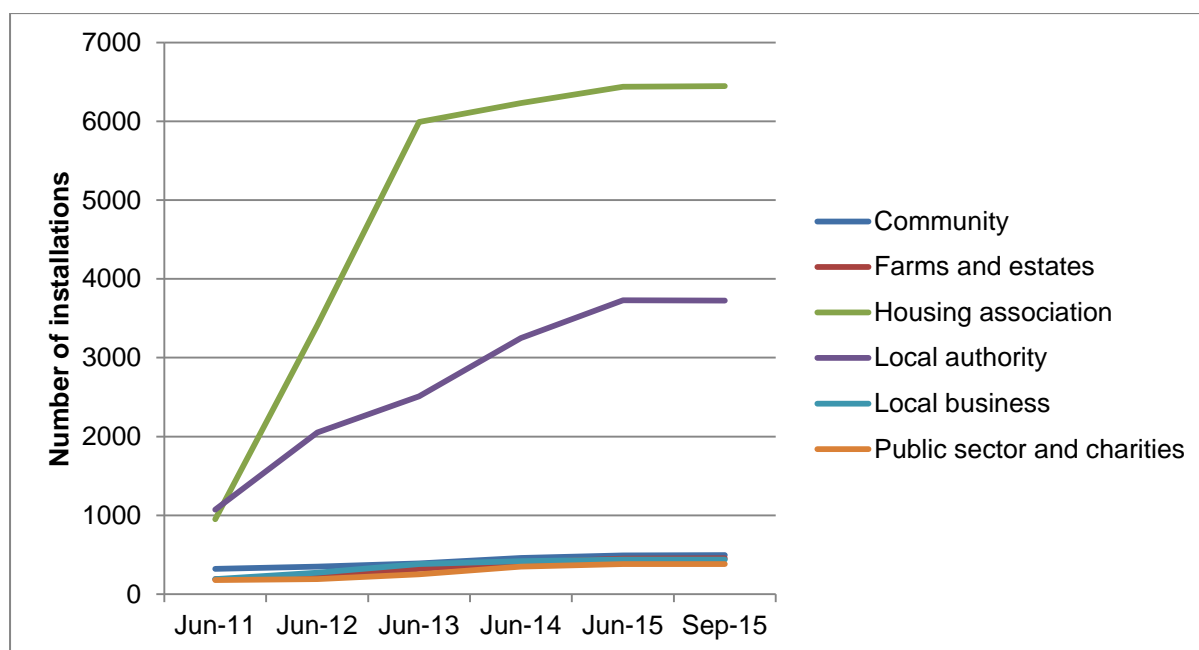


Figure 14. Increase in the number of installations from June 2011 to September 2015, by ownership category⁴³



⁴² Operational capacity recorded in September 2015 version of database. Figures may differ from figures in previous iterations of this report.

⁴³ Number of installations recorded in September 2015 version of database. Figures may differ from figures in previous iterations of this report.

While these trends are promising for the future of community and locally owned renewable energy in Scotland, it is important that progress beyond the 500MW target continues to be monitored. In previous iterations of this report there has been a significant time lag between the end of the reporting period (for previous reports this has been June of each year) and the publishing of the report. Moving forward, the intention will be to update the database on a more regular basis.

While annual surveys will still be used to collect information from local authorities and housing associations on their renewable installations, updates on current projects and details of new projects received by the Energy Saving Trust will be added to the database throughout the year. The database will then be used to update the Local Energy Scotland community and locally owned renewable energy map⁴⁴ on a monthly basis. This map provides details of community and locally owned renewable energy projects in Scotland and tracks the total operational community and locally owned renewable energy capacity⁴⁵. As well as increasing awareness of community and locally owned renewable projects, it is also hoped that the Local Energy Scotland map will act as a platform for members of the public to inform the Energy Saving Trust of new projects. (Contact details are provided on the relevant page on the Local Energy Scotland website along with text encouraging users to inform us of any new projects, or changes to projects currently shown⁴⁶.)

The monthly updates to the map will have the limitation of not being complete updates, but the new process should allow progress to be monitored more closely than has been possible in previous years.

While a large amount of work has been put into improving the quality of the data held in the database over the last few years, there are still some areas in the report where improved clarity of data would be very helpful. For example, a number of smaller installations are being continually recorded as 'consented not built' as it is difficult to track them post-planning. The quality and coverage of the data could be greatly improved with full access to data on Renewable Heat Incentive (RHI) and Feed-in Tariff (FIT) projects. This would provide much better information on the smaller installations, allowing us to:

1. Identify projects that are now operating yet are recorded as being at one of the 'in development' stages.
2. Identify projects that are not available from the other data sources.

⁴⁴ www.localenergyscotland.org/projects

⁴⁵ Only projects with capacities of over 50kW that can be shared publically will be published on the map. Projects not published on the map are still counted towards the overall total renewable energy operational capacity in Scotland.

⁴⁶ <http://www.localenergyscotland.org/projects/about/>

Appendix 1: Full methodology

The actions taken and assumptions used to try to ensure minimal gaps in the information contained in the community and locally owned renewable energy database are described below.

Definition of ‘community and locally owned’

As with previous versions of the database, the Scottish Government has requested that ‘community and locally owned renewable energy’ be defined as technologies producing heat and/or electricity from a renewable source⁴⁷, where the owner of the installation is in one of the following categories:

- A community group.
- A local Scottish business.⁴⁸
- A farm or estate.
- A local authority.
- A housing association.
- ‘Other public sector and charity’, including:
 - Charities, including faith organisations.
 - Public bodies or publicly owned companies.
 - Further or higher education establishments such as universities and colleges.
 - Recipients of Scottish Community and Householder Renewables Initiative (SCHRI) grants under the community stream of the programme (but not recipients of grants under the householder stream).
 - Recipients of Community and Renewable Energy Scheme (CARES) grants.

‘Ownership’ has not been restricted to cases where the organisation owns the entire renewable installation. It also includes cases where, for example, a community group or farmer has helped to meet part of the cost of developing and installing a renewable system in return for some benefit, such as a share in the income generated. In such cases, a percentage of the installation’s capacity equal to the share owned by the community or local owner is counted towards the target.

‘Ownership’ does not include cases where the only benefit to the farmer or community group is a land rental payment from the owner or developer of the installation, or installations that generate community benefit payments but are owned by another organisation (for example a wind farm owner). The Scottish Government has established a register of community benefits from renewable energy projects⁴⁹ in order to help communities and renewable energy developers negotiate appropriate levels of community benefit payment.

⁴⁷ A full description of each eligible technology is given in appendix 2.

⁴⁸ Note this excludes Scottish businesses whose purpose is to develop renewable energy projects.

⁴⁹ <http://www.localenergyscotland.org/view-the-register/>

There is naturally some overlap between the different categories of owners. For example, some community groups have charitable status, as do many housing associations; and farms and estates could also be considered Scottish businesses. For the purposes of this report, the following definitions have been used to allocate which category each installation belongs to:

- **Communities** have been defined as communities of place, i.e. based around a sense of shared location. They often have charitable status. In some instances the renewable technology and/or income from it may be owned by a trading subsidiary, which may be registered as a separate company.
- **Charities** have been defined as charitable organisations which are not also a community group, e.g. the Royal Society for the Protection of Birds (RSPB). ‘Charity’ has also been taken to include leisure trusts⁵⁰, and churches and other religious organisations.
- **Public bodies** are those listed in the National Public Bodies Directory⁵¹, including NHS health boards. Other publicly-owned organisations such as the fire and rescue services and the police forces are also included in this category, although they are not strictly public bodies.
- **Further or higher education establishments** are the colleges and universities who are members of the Association of Scotland’s Colleges (ASC)⁵² or Universities Scotland.⁵³
- **Local Scottish businesses** are small or medium-sized enterprises (SMEs) registered with Companies House⁵⁴ at an address in Scotland. Businesses receiving funding through the Community and Renewables Energy Scheme (CARES) or through Resource Efficient Scotland (RES) SME loans have been included. Note this definition excludes Scottish SMEs whose purpose is to develop renewable energy projects at a location significantly removed from their registered office, and where the business does not own the land where the installation will be built.⁵⁵
- **Farms or estates** are those organisations where the renewable technology is installed on land currently used for agricultural or other farming purposes, or on buildings that are part of a farm or estate layout; and (where the installation needs planning permission) where the person or organisation listed as the applicant in the planning application gives their address as being in Scotland. Estate ownership is often difficult to establish, but where possible publicly available information has been used to establish whether estate owners are

⁵⁰ Leisure trusts supply sports facilities to local communities, often on behalf of unitary authorities. For example, see: <http://www.edinburghleisure.co.uk/list-116>

⁵¹ <http://www.scotland.gov.uk/Topics/Government/public-bodies/about/Bodies>

⁵² <http://www.scotlandscollleges.ac.uk/About-Us/about-us.html>

⁵³ <http://www.universities-scotland.ac.uk/>

⁵⁴ <http://www.companieshouse.gov.uk/>

⁵⁵ For example, an SME established to build and operate a renewable energy project could count as a ‘local Scottish business’ for the purposes of the target if it was registered with Companies House at an address in Scotland, and either a) owned all the land where the installation was to be built, or b) if it did not own all the land, if its registered address indicated that it was physically located close to the address of the proposed installation.

normally resident on the estate where the installation is to be built. Farms and estates receiving funding through Local Energy Scotland have been included.

- **Local authorities** are the 32 unitary local authorities.
- **Housing associations** are providers of social housing within Scotland, other than local authorities.

Note on the units used in the report

“*Capacity*” refers to the maximum instantaneous power output of a renewable energy system, in either electricity or heat. The capacity of electricity-producing technologies is usually measured in kilowatts of electricity (kWe) or megawatts of electricity (MWe), depending on the size of the installation. The capacity of heat-producing technologies is measured in kilowatts-thermal (kWth) or megawatts-thermal (MWth), again depending on the size of the installation. Where this report refers to capacity from both renewable heat and renewable electricity technologies, the figures are given simply in kW or MW. One megawatt is equal to one thousand kilowatts.

Combined heat and power units have figures for electrical capacity and heat capacity. Where such installations are referenced in this report the total capacity in MW (MWe + MWth) is reported. However, the supporting database attempts to provide both figures (electrical capacity and heat capacity).

Solar PV capacity can be referred to in kilowatt-peak, or kWp, which is interchangeable with kWe.

“*Energy output*” is estimated for each technology on an annual basis. Energy is reported in megawatt-hours (MWh) or gigawatt-hours (GWh). One gigawatt-hour is equal to one thousand megawatt-hours.

Approach taken and data sets used

The approach taken to collect data from each source is broadly in line with that taken to produce the previous versions of the database and report – with some updates – and is outlined below. With additional resources available for the update of this and the previous year’s report, a significant amount of time has been spent reviewing records for which detailed information has been previously hard to find. Further checks have been done to assure quality of data and to decrease the possibility of double counting. This has resulted in a marked decrease in the number of installations for which the capacity, technology or operating status is unknown and an increase in the quality of the data. Additionally, to enhance the quality improvement the final dataset used to compile the figures in this report have been through an internal quality check, even so there are still uncertainties associated with the methodology used to compile the data. These are discussed later in this section.

The database was originally updated to contain information correct as of June 2015 (in line with previous years' reports which have also reported on status as of June); however the data collation period was then extended to the end of September 2015. For projects where no update on operating status was received between June and September 2015, it was assumed that the project was still as the same operating status that had been recorded previously (i.e. if a project was reported to be 'under construction' as of June 2015 and no new information was received, the operational status for 'September 2015' was also recorded as 'under construction'). For consistency within this report, all information is assumed to be correct as of September 2015.

Due to the large number of different organisations and different technologies covered by the Scottish Government's definition of 'community and locally owned renewable energy', information is sought from a variety of sources. This includes organisations administering Scottish Government or other public funding streams, local authorities and planning authorities, public bodies (e.g. NHS and Highlands and Islands Enterprise) and other groups of organisations which we believe are likely to be renewables owners themselves. In some cases, organisations were able to provide information about installations in more than one ownership category; and for each ownership category there were a number of different information sources used:

- **Data from funding and delivery organisations**

There have been a variety of funding sources available in recent years to promote the uptake of renewable energy generation among different groups, such as communities and farms. Therefore an important source of information for this database was information on the organisations who have received such funding, which was provided either by the funding organisation themselves (e.g. Scottish Government) or delivery and administration organisations (e.g. Local Energy Scotland, Energy Saving Trust and Ofgem).

- **Data from local authorities**

A survey was sent by email from Home Energy Scotland to all 32 Scottish local authorities enquiring about renewable energy technologies fully or partly owned by local authorities. A new survey layout was introduced for this year's report in order to simplify the process for local authorities and increase the quality of the data received. Completed surveys were received from 18 local authorities, representing a 56% respond rate. As this survey has now been done four times for annual updates of the community and locally-owned database, we now have some information on all 32 local authorities.

- **Data from housing associations**

An online survey was sent by email from the Energy Saving Trust and the SFHA on behalf of the Scottish Government to all SFHA members enquiring about renewable technologies fully or partly owned by housing associations. As with the local authorities, a new improved survey was made for requesting data from the housing associations. Additional information to include in the database was received from 38 housing associations. This is fewer than the 44 responses received in the previous year, but the quality of data returned was considerably higher.

- **Data from the UK Renewable Energy Planning Database**

The UK Department of Energy and Climate Change (DECC) shared information from the Renewable Energy Planning Database (REPD)⁵⁶, which was maintained on their behalf by Ricardo-AEA. The REPD aimed to track the progress through the UK planning system of all renewable electricity-generating technologies with an electrical generation capacity of 0.01MWe (10kWe) and greater, and of some heat-generating installations. However, it does not record details of ownership. From October 2014 the REPD ceased tracking installations that are smaller than 1MWe. As this report reflects operating status as of September 2015, this change in process is likely to have had some impact on the tracking of smaller installations since October 2014. Alternative sources are being considered for tracking these smaller installations in the future.

- **Data from planning authorities**

Information from DECC's REPD was used in conjunction with publicly available information from Scotland's planning authorities to determine ownership of installations.

Further information sources included:

- Information from individual installation owners, where necessary to confirm details such as capacity or ownership in response to telephone or e-mail contact.
- Information available on Community Energy Scotland's website⁵⁷ and in its newsletters.
- Individual community group, charity or housing association websites.⁵⁸

Wherever possible, the information sought included:

- Name of the project.
- Ownership (organisation and type of organisation).
- Where appropriate, the name of the subsidiary trading company owning the renewable technology on behalf of the community group/charity.
- Location, including local authority area, address, and a postcode and/or grid reference.
- Technology type.
- Number and installed capacity of the technologies installed.
- Operational status as at September 2015 (operating/under construction/consented not built/in planning/in scoping/ non-operational/ decommissioned), including where possible the date on which generation commenced for operational projects.
- Percentage ownership by the community group etc, in cases where the organisation did not have full ownership of the installation.
- Where appropriate, the building type associated with the renewable energy installation, to aid cross-checking with other sources, help to clarify organisation type, and to estimate yearly energy output.
- Whether public grant or loan funding was received, to aid cross-checking with information received from bodies administering those funds.

⁵⁶ <https://restats.decc.gov.uk/cms/>

⁵⁷ <http://www.communityenergyscotland.org.uk/>

⁵⁸ For example: <http://neilstonwindfarm.org/ourwindfarm.html>

Other data sources not used in this update of the database

The information sources listed below were investigated for the first version of the database and report, but the publically available information on these was found to contain either information captured elsewhere or insufficient detail for this project.

- Carbon Reduction Commitment (CRC) Energy Efficiency Scheme (administered in Scotland by SEPA on behalf of DECC).
- The Feed-in Tariff (FIT) scheme (administered by Ofgem on behalf of DECC).
- The Renewable Heat Incentive (RHI) (administered by Ofgem on behalf of DECC).
- Installations registered for the Climate Change Levy, and Renewable Energy Guarantees of Origin (administered by Ofgem on behalf of DECC).
- Scotland's Climate Change Declaration.

Data quality

Not all the required information was available from all sources. Given the large number of installations covered by the community and locally owned renewables database, it was not possible to contact each project individually, or to track down all missing details from other sources. Priority was given to ensuring the database contained the correct information with regards to: technology type; operational status; installed capacity; and % community or local ownership share.

In certain circumstances assumptions have been made about the operating status. If information for a project has been found in previous years but no further information has been found for the September 2015 update the following assumptions have been made: if a project has been previously recorded as 'in scoping' and no further information has been found, then the assumption has been made that it is still at the same stage of development. Projects that have had planning permission granted but where there is no further information have been assigned the status 'consented but not built'. The status of projects that were 'under construction' as of June 2014 has remained the same if no evidence has been found that the project is operational.

The quality of data provided varied considerably. In particular, installed capacity was often not provided, and operational status was sometimes unclear.⁵⁹ Technology type was sometimes also unclear (for example 'solar', which does not indicate whether the installation is a solar PV panel generating electricity, or a solar thermal panel generating hot water). In these cases we have recorded as much information as has been provided by the data source but have not made assumptions on the technology or size of system. In some cases a known capacity has been recorded, but the technology type is unknown. As the annual output assumptions used are dependent on technology type, the annual output for these systems cannot be estimated. As mentioned previously, during this reporting year an emphasis has been placed on finding additional information on these systems where possible.

⁵⁹ For example, grant and loan schemes frequently record the stage of the application for funding (loan offered or paid), but not the stage of the renewable technology itself e.g. under construction or operational.

Data received from DECC's Renewable Energy Planning Database (REPD) provided very good location data and operational status, but did not contain information on ownership, which had to be sought from other sources (mostly the planning authorities).

Location data was often missing or incomplete. In the case of projects still in scoping, location had not always been decided at the time of data collection. Local authority area has been identified for each project.

Uncertainty levels associated with the methodology

In any analysis of this kind where data is gathered from a variety of different sources, total data coverage may be incomplete. This is for a number of reasons for example:

- Incomplete information may be received on some installations.
- The number of sectors and technologies that the database covers means there is a chance that some installations may have been missed altogether.

Large capacity renewables installations are typically higher profile projects, and more likely to require planning permission (and planning records are a very good source of reliable information). So issues with data collection are more likely for smaller capacity installations such as heat pumps and solar thermal panels.

The opposite problem (double-counting installations) is also a potential issue, although efforts have been made to avoid it. Due to the large number of data sources and the varying level of detail provided by different organisations there remains a risk that some double-counting of installations or their capacity may have occurred. Again, as large capacity renewables installations are typically higher profile projects, and more likely to require planning permission, double-counting is most likely for smaller capacity installations such as heat pumps and solar thermal panels, and so less likely to significantly affect the overall figures.

Some points for particular consideration in relation to data coverage and data quality are:

- **Information received from local authorities**

In the course of compiling the database, Home Energy Scotland sent an email survey to all 32 local authorities in Scotland on behalf of the Energy Saving Trust and Scottish Government, asking them to provide information on all renewable technologies fully or partly council-owned. As this survey has now been done four times for the community and locally-owned database, we now have some information from all of the 32 local authorities. However, due to the large numbers of different building types for which councils have responsibility (social housing, council offices, schools, waste collection facilities) and the large number of different council departments which are involved in maintaining these, we could not always guarantee that the response received provided a full picture of all council-owned stock. For this report, a survey response was received from 18 of the 32 local

authorities. As renewable capacity reported for local authority stock varied greatly, no attempt was made to scale up known capacity to account for non-respondents.

- **Information received from housing associations**

The Scottish Federation of Housing Associations (SFHA) and the Energy Saving Trust sent an email survey on behalf of the Scottish Government to all members of the SFHA. 38 of the housing associations who replied provided information on renewable capacity they had installed, and only 8 replied to say they owned no renewable energy capacity. Given the range of reported installed capacity per housing association, no attempt was made to scale up known capacity to account for non-respondents.

- **Projects in the scoping phase of development**

It is difficult to gain information on projects which are still in the early development stages, particularly if the applicants are not eligible for financial support from the funding organisations the Energy Saving Trust contacted while compiling this database. This will be particularly true of farms and estates intending to install wind turbines, which typically have large capacities as we would not be aware of these projects until they enter the planning process. Therefore the figures presented here for installations in scoping are highly likely to be an underestimate.

- **Projects in the planning phase of development**

In compiling the database, information received from DECC's REPD was a source of good quality information on renewable energy installations where the owner had applied for planning permission. Many smaller capacity renewable energy installations (such as solar panels on domestic-sized properties and ground source heat pumps used for space heating in small buildings) do not require planning permission and so will not be captured by this information source. However, larger capacity renewables do require planning permission in most cases and so will have been captured from this data.

Share of capacity in community and local ownership

As noted earlier, the definition of 'ownership' used in this analysis was not restricted to cases where the organisation owns the entire renewable installation. It also included cases where, for example, a community group or farmer helped to meet part of the cost of developing and installing a renewable energy system in return for some benefit, such as a share in the income generated. In such cases, a percentage of the installation's capacity equal to the share owned by the community or local owner is counted towards the target.

Such instances are normally wind energy developments, where perhaps the best known example is the wind turbine 'owned' by Fintry Renewable Energy Enterprise, the trading subsidiary of Fintry Development Trust⁶⁰, which is part of the larger Earlsburn Wind Farm. In this case, the turbine owned by Fintry has a capacity of 2.5MWe, so Fintry Development Trust's entry in the community

⁶⁰ <http://www.fintdyt.org.uk/index.php?page=about>

and locally owned database lists one turbine of 2.5MW, although the full capacity of Earlsburn wind farm is much larger (around 35MW).

There are other examples in the database, such as the Neilston Development Trust's joint venture with a commercial partner to develop a community wind farm in East Renfrewshire⁶¹. In this case, the community secured loans to finance a 28% stake of the project. Therefore the 'community and locally owned renewable energy' capacity of the Neilston wind farm has been calculated in the database as 28% of the total expected installed capacity of the development.

Energy4All wind farms were a special case for consideration. Energy4All works to help establish wind energy co-operatives in the UK, and this work has included the establishment of four operational wind farm co-operatives in Scotland⁶². Members of the local community can buy shares in the developments. In these cases, information on the percentage of community ownership was received from Energy4All, and the percentage applied to the total installed capacity of the site to estimate the MWe in community and local ownership. No new Energy4All projects have been added to the database since the June 2014 updates.

Capacity estimates where values were not available

As previously noted, not all required information was available for all renewable energy installations. In some cases, the installed capacity was one of the figures that were unavailable.

Every effort was made to confirm capacity with the owners of installations. However, because of the large number of installations covered in this work it was not always possible to obtain this information for all installations within available resources.

For installations where a value for capacity was not provided, an estimate was made for likely installed capacity based on technology type, ownership category and building type (where appropriate). These were derived from similar installations where capacity was known, or using other assumptions as given below. A note of the values assumed for capacity is given in appendix 4.

For some installations, an estimate of yearly energy output was supplied instead of a value for capacity. In those cases, installed capacity was estimated using the assumptions detailed in table 12.

Information on solar thermal panels and solar PV panels was sometimes provided in area (m²) of panel. In such cases, the conversion factors used to estimate capacity are given in table 11.

⁶¹ <http://www.neilstontrust.co.uk/what-we-do/go-neilston/community-windfarm.html>
⁶² <http://energy4all.co.uk/>

Table 11: Assumptions used to estimate capacity of solar thermal and solar PV panels

<u>Technology</u>	<u>Value used</u>	<u>Units</u>	<u>Information source</u>
<u>Solar thermal panel, average capacity per m²</u>	<u>0.7</u>	<u>kWth/m²</u>	<u>Solar Trade Association.</u>
<u>Solar PV panel, average capacity per m²</u>	<u>0.14</u>	<u>kWp/m²</u>	<u>Energy Saving Trust Solar Energy Calculator tool assumptions.⁶³</u>

Yearly energy output

The assumptions used to estimate yearly output in MWh of energy from community and locally owned renewable energy sources are given in table 12.

For solar thermal panels and solar PV panels, yearly energy output was estimated using the following method:

Total installed capacity (kW), divided by capacity per m² (kW/m²), multiplied by factor for yearly output per m2 (kWh/m²/yr) = yearly energy output (kWh).

For all other technologies, the formula used was:

Total installed capacity (kW), multiplied by estimate of peak load hours per year (h) = yearly energy output (kWh).

⁶³ Scottish average calculated using data from: <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-panels-PV/Solar-Energy-Calculator>

Table 12. Assumptions used to estimate yearly energy output.

Technology	Value used	Units	Information source
Solar thermal panel, yearly energy output per m ² .	441	kWh/m ² /year	Derived from MCS calculations recreated using EST standard assumptions for occupancy and panel size.
Solar PV panel, yearly electricity output per m ² .	99	kWh/m ² /year	Energy Saving Trust Solar Energy Calculator tool assumptions. ⁶⁴
Yearly peak load hours for small wind turbines (10kW and under).	1,664	hours/year	Energy Saving Trust field trial of domestic small-scale wind turbines. ⁶⁵
Yearly peak load hours for larger wind turbines (over 10kW).	2,365	hours/year	Scottish Renewables
Yearly peak load hours for hydro electricity.	3,500	hours/year	Various ⁶⁶
Yearly peak load hours for anaerobic digestion (electricity production).	5,256	hours/year	RESTATS (Ricardo-AEA on behalf of DECC). ⁶⁷
Yearly peak load hours for biomass combined heat and power (electricity production).	8,000	hours/year	(Energy Saving Trust expert assumption)

⁶⁴ Scottish average. <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Solar-panels-PV/Solar-Energy-Calculator>

⁶⁵ <http://tools.energysavingtrust.org.uk/Publications2/Generating-energy/Field-trial-reports/Location-location-location-domestic-small-scale-wind-field-trial-report>

⁶⁶ The following sources were used, which indicated that a reasonable assumption to use would be 3,500 peak hours per year, equivalent to a 40% load factor.

- Garrad Hassan report on renewable energy potential for Scottish Renewables
- The British Hydropower Association's mini hydro guide (V3), http://www.british-hydro.org/Useful_Information/A%20Guide%20to%20UK%20mini-hydro%20development%20v3.pdf
- Scottish Hydropower Resource Study for FREDS, Aug 2008, <http://www.british-hydro.org/UK%20Hydro%20Resource/Scottish%20Hydro%20Resource%20Study%20Aug%202008.pdf>

However, estimates of output from hydroelectric installations should be treated with caution because it is highly site specific.

⁶⁷ <https://restats.decc.gov.uk/cms/regional-renewable-statistics/#Data>

Yearly peak load hours for tidal electricity generation.	3,066	hours/year	Scottish Renewables
Yearly peak load hours for heat pumps or biomass providing space heating for one type of building (excluding low usage buildings e.g. community halls). Includes district heating that provides space heating to only one category of building e.g. only domestic properties.	2,500	hours/year	As used for estimating output in Renewable Heat in Scotland. ⁶⁸
Yearly peak load hours for heat pumps or biomass providing space heating for low usage buildings e.g. community halls and churches.	250	hours/year	As used for estimating output in Renewable Heat in Scotland. ⁶⁹
Yearly peak load hours for biomass providing heat for a commercial process (where the installation is sized between 45kW and 1MW), or providing space heating via district heating for more than one type of building.	5,000	hours/year	As used for estimating output in Renewable Heat in Scotland. ⁷⁰
Yearly peak load hours for biomass providing heat for a commercial process (where the installation is sized 1MW or over).	8,000	hours/year	As used for estimating output in Renewable Heat in Scotland. ⁷¹

(With thanks to Scottish Renewables for providing guidance on estimates of capacity factors for many of the electricity-generating technologies).

⁶⁸ Energy Saving Trust for the Scottish Government: <http://www.energysavingtrust.org.uk/renewable-heat-report-2014>

Note that DECC uses an estimate of 1,314 peak load hours per year (equivalent to a 15% load factor) as the tier-break point between tier 1 and tier 2 prices paid for heat from small and medium non-domestic biomass under the Renewable Heat Incentive. However this is noted by DECC as being a reasonable estimate of a minimum level of usage that could be expected. Therefore 2,500 peak load hours has been used here, which is consistent with estimates of renewable heat in Scotland, as an estimate of total peak load hours for space heating in Scotland.

http://www.decc.gov.uk/en/content/cms/meeting_energy/Renewable_ener/incentive/incentive.aspx

⁶⁹ Energy Saving Trust for the Scottish Government. <http://www.energysavingtrust.org.uk/renewable-heat-report-2014>

⁷⁰ Energy Saving Trust for the Scottish Government. <http://www.energysavingtrust.org.uk/renewable-heat-report-2014>

⁷¹ Energy Saving Trust for the Scottish Government. <http://www.energysavingtrust.org.uk/renewable-heat-report-2014>

Appendix 2: Individual technology descriptions

The following renewable technologies have been included in the database:

- **Wind (including wind to heat)**

Wind turbines have blades which are turned by the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. They may be pole-mounted or building-mounted, and may be connected to the national electricity grid, a local distribution grid, or stand-alone. Wind to heat installations ('wind to heat') where the turbines produce electricity which is used to directly charge electric storage heaters for space heating have also been included. In 'wind to heat' cases the recorded capacity is that of the turbine.

- **Hydroelectric**

A flow of water falling from a higher level to a lower level (and not from waves or tides) is used to drive a turbine which generates electricity.

- **Wave and tidal (marine energy)**

The action of waves or tides is used to drive a turbine, which generates electricity.

- **Solar photovoltaics (PV)**

Panels or modules, normally fixed to the roofs of buildings, which produce electricity when exposed to sunlight (either direct or indirect).

- **Biomass primary combustion**

Biomass is burnt to directly produce space or water heating. Here 'biomass' has been taken to mean wood chips, pellets or logs. It is also possible (as in the Lerwick district heating scheme in Shetland) for other organic or putrescible matter, such as food waste, to be burnt to produce heat, but in these cases the installation has been classified as 'energy from waste' (EfW).

- **Biomass combined heat and power (CHP)**

Biomass is burnt in order to generate electricity. Heat is produced as a by-product, which can then be used for process heat, or for supplying space and/or water heating. Again, this biomass could either be wood products; or it could waste material with an organic component, such as municipal waste, but in such cases the installation would be classed as 'energy from waste'.

- **Solar thermal panels**

Panels normally fixed to the roofs of buildings, which produce hot water using the sun's heat. Occasionally these systems are designed so that the hot water produced also contributes to space heating demand (solar space heating).

- **Heat pumps**

Technologies to extract low-grade heat from the external environment (the ground, air or a body of water) and produce heat for space and/or water heating, using a compression system. Although heat pumps rely on electricity to operate, their high co-efficient of performance (COP) means they extract more heat energy from the environment than they use in electricity. Exhaust air heat pumps,

which in addition to extracting heat from the external air also draw warmth from warm stale air leaving a building, have been included within the air source heat pumps category. Units which are purely exhaust air heat recovery (EAHR) and that do not also extract heat from the air outside have not been included.

- **Energy from waste technologies:**

- **Anaerobic digestion (AD)**

Organic matter is broken down in the absence of oxygen to produce methane gas. This is then burnt to generate heat and/or electricity. Some of the heat produced is usually used to help maintain the AD digestion process itself.

- **Landfill gas capture**

Landfill gas (methane from rotting organic matter in landfill) is captured and burnt to produce heat or used in a combined heat and power unit to generate electricity and heat.

- **Waste incineration**

Municipal or industrial waste can be burnt to provide heat. A proportion of the total capacity that is equal to the percentage of biodegradable matter in the waste is taken to be renewable energy capacity.

Another technology which could have been included in the database if examples had been found was:

- **Fuel cell biomass**

Fuel cells running on biomass could be used to produce electricity and useful heat. However, none were identified in Scotland for this version of the database.

Technologies which have not been included in the database, as they do not produce energy from renewable sources, are:

- **Non-biomass CHP**

Combined heat and power units fuelled by gas (or other fossil fuels) to produce electricity and heat. CHP (or tri-generation) units can represent an efficient use of fuel as they achieve high efficiencies. However, as the energy from such units is generated from fossil fuel sources, it has not been counted towards renewable energy targets in this report.

- **Exhaust air heat recovery (EAHR) only**

Systems which recover the heat from warm stale air leaving a building and use it to warm incoming air. This can help to reduce space heating requirements. However, because the heat being recovered for the building will normally have been generated by fossil fuels in the first instance, these systems do not provide renewable heat. Some heat pumps have been included which are classed as 'exhaust air heat recovery', but only where it was possible to ascertain that they also

provided heat taken from the air outside the building (which is renewable heat) via a heat pump component.

- **Passive renewable heating or cooling**

The building design is used to ensure heating or cooling without relying on mechanical means, for example through features such as solar gain through large areas of south-facing glazing, or 'natural ventilation'. Such design features can successfully help a building meet its heat demand, however they have not been included in this report or in the database as the heat resource is very difficult to estimate.

Appendix 3: List of main data sets used

Table 13 lists the main data sources used in this update of the community and locally-owned renewable energy database, by ownership category and data provider. Details of the data sources used for previous versions of the database can be found in the relevant reports.

Table 13. Main data sets used

<u>Organisation(s) contacted/providing data</u>	<u>Dataset(s)</u>	<u>Ownership categories</u>
<i>Local Energy Scotland</i> , on behalf of the Scottish Government	The Community and Renewable Energy Scheme (CARES); Local Energy Challenge Fund (LECF).	Communities; Farms and estates; Local businesses. ⁷²
<i>Energy Saving Trust</i> , on behalf of the Scottish Government.	The district heating loans fund.	Local authorities; Housing associations; ⁷³ Communities; ⁷⁴ Farms and estates; Local businesses.
<i>Energy Saving Trust</i> , on behalf of the Scottish Government.	The Warm Homes Fund.	Local authorities; Housing associations. ⁷⁵
<i>Energy Saving Trust</i>	CESP- and ECO-funded renewable energy projects in Scotland.	Local authorities; Housing associations.
<i>Resource Efficient Scotland</i> , on behalf of the Scottish Government.	Resource Efficient Scotland small and medium-sized enterprises loans scheme.	Local businesses.
<i>Community Energy Scotland</i>	Operational revenue generating community energy projects database.	Communities.
<i>Forestry Commission Scotland</i>	Wind and hydroelectric schemes on the National Forest Estate (publicly available information).	Communities; Other public sector and charity organisations; Farms and estates; Local businesses.
<i>NHS National Services Scotland</i>	Operational renewable energy installations on the NHS Scotland estate.	Other public sector and charity organisations.

⁷² Local businesses must also be rural businesses to be eligible for CARES funding.

⁷³ The district heating loans fund is also open to other registered social landlords.

⁷⁴ Communities must be legally constituted community groups to apply for the district heating loans fund.

⁷⁵ The Warm Homes Fund is also open to other registered social landlords, and to energy services companies (ESCOs) set up by housing associations, local authorities or registered social landlords.

Individual local authorities, via <i>Home Energy Scotland</i>	Responses to an Energy Saving Trust e-mail survey of all local authorities, using contacts from the Home Energy Scotland advice network.	Local authorities.
Individual housing associations, via the <i>Scottish Federation of Housing Associations (SFHA)</i>	Responses to an SFHA and Energy Saving Trust e mail survey of all SFHA housing association members in Scotland.	Housing associations.
<i>Ricardo-AEA</i> , on behalf of the <i>UK government's Department for Energy and Climate Change</i>	Extract from the Renewable Energy Planning Database.	Local authorities; Housing associations; Communities; Other public sector and charity organisations; Local businesses; Farms and estates.
<i>The UK Government's Department for Energy and Climate Change</i>	Renewable Heat Premium Payment (publicly available information).	Local authorities; Housing associations.
<i>Renewable UK</i>	UK Wind Energy Database.	Farms and estates; Communities; Other public sector and charity organisations.
<i>Ofgem</i>	Renewables and CHP Register.	Public sector: (Scottish Water).

Appendix 4: Capacities assumed for individual installations where information was not available

Table 14 shows the assumed capacities that were used in the community and locally owned renewable energy database where information on capacity was not available.

Table 14. Assumptions for capacity by technology and building type (where other information was not available).

<u>Ownership category</u>	<u>Building type</u>	<u>Technology</u>	<u>Estimate of likely installed capacity</u>	<u>Derived from</u>
Community	Community buildings	Solar PV	8kWe	Average of other community PV installations recorded in the database.
	Community buildings	Solar thermal	6kWth	Average of other community solar thermal installations recorded in the database.
	Community buildings	Wind (including wind to heat) – grant funded	6kWe	Average of other community wind installations recorded in the database. ⁷⁶
	Community buildings	Heat pumps (ASHP and GSHP)	16kWth	Average of other heat pumps in public sector, LA non-domestic and community buildings, recorded in the database.
	All	Biomass	45kWth	Average of other community biomass installations recorded in the database.

⁷⁶ This average excludes large-scale wind developments, and was used as the assumed capacity for wind turbines installed under SCHRI or CARES grant schemes (where this information was not provided), and in cases where other information provided indicated that the turbine was associated with a community hall or other small building, rather than being part of a larger development. Revenue-generating wind projects (which are typically not grant funded) are more variable in size. However as these tend to be large in size (typically 800kW and over), effort has been made to determine the exact size of each installation for non-grant funded community wind projects.

	All	Biomass district heating	250kWth	Average of other community biomass district heating installations recorded in the database.
Other public sector and charity	All	Solar thermal	13kWth	Average of other public sector and charity solar thermal installations recorded in the database.
	All	Wind – grant funded	6kWe	Average of other public sector and charity wind installations recorded in the database. ⁷⁷
	All	Heat pumps (ASHP and GSHP)	16kWth	Average of other heat pumps in public sector, LA non-domestic and community buildings recorded in the database.
	All except hospitals	Biomass	150kWth	Average of other public sector and charity biomass installations, excluding hospital installations, recorded in the database.
	Hospitals	Biomass	1.7MWth (1,700kWth)	Average of other hospital biomass installations recorded in the database.
Farms and estates	All	Biomass	150kWth	Average of other farm and estate biomass installations recorded in the database.
	All	Biomass district heating	150kWth	Average of other farm and estate biomass district heating installations recorded in the database.

⁷⁷ This average excludes large-scale wind developments, and was used as the assumed capacity for wind turbines installed under SCHRI or CARES grant schemes (where this information was not provided), and in cases where other information provided indicated that the turbine was associated with a small building, rather than being part of a larger development. Revenue-generating wind projects (which are typically not grant funded) are more variable in size. However as these tend to be large in size (typically 800kW and over), effort has been made to determine the exact size of each installation for non-grant funded wind projects.

	All - Scotland Rural Development Programme (SRDP) grant recipients only	Hydro-electric	9kWe	Average of other farm and estate hydroelectric installations recorded in the database. ⁷⁸
Local businesses	All	ASHP	16kWth	Average of other local business ASHP's recorded in the database.
	All	GSHP	30kWth	Average of other local business GSHP's recorded in the database.
	All	Biomass	200kWth	Average of other local business biomass recorded in the database.
	All	Biomass district heating	150kWth	Average of other local business biomass district heating recorded in the database.
Local authority	Domestic properties	Solar thermal – installed in 2011, 2012 or 2013	3.4m ²	Analysis of Energy Saving Scotland home renewables grants. ⁷⁹
	Domestic properties	Solar thermal – installed in 2014 or 2015	4m ²	Analysis of Energy Saving Scotland home renewables loans paid in 2014. ⁸⁰
	Domestic properties	Solar PV – installed in 2011 or 2012	2.8kWe	Analysis of installations registered for FITs in Scotland. ⁸¹

⁷⁸ Based on information received on size of hydroelectric capacity installed under SRDP, therefore only used for other SRDP hydroelectric installations where capacity was not known. Revenue-generating hydroelectric projects (which are typically not grant funded) are more variable in size. However as these tend to be large in size (typically 100kW and over), effort has been made to determine the exact size of each installation for non-grant funded hydroelectric projects.

⁷⁹ Energy Saving Scotland home renewables grants (no longer available) were grants for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.

⁸⁰ Energy Saving Scotland home renewables loans are loans for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.

⁸¹ Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

	Domestic properties	Solar PV – installed in 2013	3.6kWe	Analysis of installations registered for FITs in Scotland. ⁸²
	Domestic properties	Solar PV – installed in 2014 or 2015	4.0kWe	Analysis of installations registered for FITs in Scotland. ⁸³
	Domestic properties	Heat pumps (ASHP and GSHP)	7kWth	Average of other LA- and HA-owned heat pumps in domestic properties recorded in the database.
	Schools	Solar thermal	7kWth	Average of other school solar thermal installations recorded in the database.
	Schools	Solar PV	8kWe	Average of other school solar PV installations recorded in the database.
	Schools	Wind – grant funded	6kWe	Average of other school wind installations recorded in the database.
	Schools	ASHP	10kWth	Average of school ASHP installations recorded in the database.
	Schools	Biomass	200kWth	Average of other school biomass boiler installations recorded in the database.
	Other buildings	Heat pumps (ASHP and GSHP)	16kWth	Average of other heat pumps in public sector, LA and community buildings, recorded in the database.
Housing association	Domestic properties	Solar thermal	3.4m ²	Analysis of Energy Saving Scotland home renewables grants. ⁸⁴
	Domestic properties	Solar thermal – installed in 2014 or 2015	4m ²	Analysis of Energy Saving Scotland home renewables loans paid in 2014. ⁸⁵
	Domestic properties	Solar PV – installed in 2011 or 2012	2.8kWe	Analysis of installations registered for FITs in Scotland. ⁸⁶
	Domestic properties	Solar PV – installed in 2013	3.6kWe	Analysis of installations registered for FITs in Scotland. ⁸⁷

⁸² Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

⁸³ Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

⁸⁴ Energy Saving Scotland home renewables grants (no longer available) were grants for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.

⁸⁵ Energy Saving Scotland home renewables loans are loans for domestic renewables, administered by the Energy Saving Trust on behalf of the Scottish Government.

⁸⁶ Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

⁸⁷ Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

	Domestic properties	Solar PV – installed in 2014 or 2015	4.0kWe	Analysis of installations registered for FITs in Scotland. ⁸⁸
	Domestic properties	Heat pumps (ASHP and GSHP)	7kWth	Average of other LA- and HA-owned heat pumps in domestic properties, recorded in the database.
	Domestic properties	ASHP - EAHR ⁸⁹	4.5kWth	Average of other LA- and HA-owned ASHP-EAHRs in domestic properties, recorded in the database.

⁸⁸ Central FIT's register, Ofgem. <https://www.renewablesandchp.ofgem.gov.uk/>

⁸⁹ ASHP - EAHR = air source heat pump with exhaust air heat recovery. Such heat pumps draw heat from both air outside a building, and heat from stale air leaving the building or extracted from rooms such as kitchens and bathrooms within the building, to provide space and water heating.

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